IN THE UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF ILLINOIS
EASTERN DIVISION

STATE OF MICHIGAN, et al.,)
) Docket No. 10 C 4457
Plaintiffs,)
) Chicago, Illinois
v) September 7, 2010
) 10:00 a.m.
UNITED STATES Army Corps of)
Engineers, et al.,)
)
Defendants)

TRANSCRIPT OF PROCEEDINGS - PRELIMINARY INJUNCTION HEARING
VOLUME 1A
BEFORE THE HONORABLE ROBERT M. DOW, JR.

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THE CLERK: 10 C 4457, State of Michigan v U.S. Army Corps.

THE COURT: Good morning again everybody.

(Chorus of "Good morning, your Honor.")

THE COURT: Let's see, I think we have at least one motion that we still need to take up here, so why don't I find out, make sure everybody is here. Everybody could do a self roll call here. I see Mr. Reichel.

MR. REICHEL: Robert Reichel.

THE COURT: Okay, and that's for the plaintiffs. Go ahead.

MR. REINWASSER: Good morning, your Honor, Lou Reinwasser from the State of Michigan, for the plaintiffs.

MR. DELONE: Bart Delone from the Commonwealth of Pennsylvania, your Honor.

MR. GUNN: Steven Gunn from the State of Minnesota, your Honor.

MR. BOCK: Dan Bock from the state of Michigan.

MS. RABE: Lee Ann Rabe from the state of Ohio.

THE COURT: Okay, good morning. So, Mr. Reichel, all the plaintiffs are here who are going to be here?

MR. REICHEL: Yes, they will be here. We are waiting for counsel from Wisconsin, but we can proceed in their absence.

THE COURT: Okay, very good, thank you. And then for

the original defendants?

MS. RUDOLPH: Good morning, your Honor, Maureen Rudolph on behalf the of federal defendant Corps of Engineers.

THE COURT: Good morning.

MR. MARINELLI: Good morning, your Honor, Matt Marinelli for the Corps of Engineers.

THE COURT: And to you good morning.

MS. NAVARO: Good morning, Ann Navaro for the Corps of Engineers.

THE COURT: Okay, very well. Good morning to all three of you.

MR. HILL: Good morning, your Honor, Ron Hill, Lisa Draper, and Brendan O'Connor on behalf of the Metropolitan Water Reclamation District.

THE COURT: Okay, very good, good morning to all of you.

And then for the intervenors.

MR. RIESER: David Rieser on behalf of the Coalition to Save Our Waterways along with Kristin Sculli from my office.

THE COURT: Okay, very good, good morning.

MR. KRAUSKOPF: Good morning, Stuart Krauskopf and Kurt Kauffman on behalf of Intervenor Wendella.

THE COURT: Okay, good morning.

MR. AMES: Good morning, your Honor, Mort Ames and Graham McCahan on behalf of the City of Chicago.

THE COURT: Okay, good morning. And then, sir, we have

got another proposed intervenor on the horizon here.

MR. RASTETTER: I am Bill Rastetter on behalf of Grand Traverse Band of Ottawa and Chippewa Indians.

THE COURT: Okay, very good. Good morning, sir. I got through my roll call and everybody is here.

The motion that we need to take up, earlier this morning at 9:30 the motion for leave to intern on behalf of the new proposed intervenor was noticed, and I heard from Mr. Rieser a potential opposition that I'm going to let him take under advisement with his client.

If anybody else has any basis for opposing that motion, we will take up a schedule on that later because the proposed intervenor is not seeking to intervene for purposes of participation in the preliminary injunction hearing, so there is no urgency to resolving that.

The second motion is Wendella's motion to request use of the court's video conference equipment. That motion -- there is, one of the experts that Wendella would like to call is -- it's Professor Ficetola, did I say that right?

MR. KRAUSKOPF: Good enough.

THE COURT: Close enough, okay. And he is in Italy. I had never gotten a request like that before, and so we consulted with Chief Judge Holderman, who is essentially, he is in charge of the video equipment in the sense that there isn't a lot of video equipment to go around here. I have

often said it's not like Mayer Brown. When I was back at Mayer Brown, if I wanted video equipment, I snapped my fingers and video equipment appeared. It doesn't happen that way here. So you have to request permission kind of writ large to use the court's video equipment.

And so we've cleared that hurdle. Judge Holderman has given us permission to use the video equipment, and the question is there is a motion then asking in this case for the equipment to be used, and the proposal is that it be used for 40 minutes. I understand from Mr. Krauskopf that it's no more than 20 minutes of direct, and I'm assuming then an equal amount of time for cross. It sounds like, you know, it's not like a red light is going to go on and the witness will disappear at the end of 40 minutes, but we are trying to apportion the use of that equipment, and so we essentially have it for roughly 40 minutes.

Is there any objection to that motion?

(No response)

THE COURT: And what I worked out with Judge Holderman then is that witness will appear on the video screen at 10:30 tomorrow, and there is no way around that. That TV there, and we did a dry run of this this morning a little after 8:00. Lois and I were sitting in the courtroom and suddenly the TV went on and a tech person from Italy appeared, and they pressed a button and showed that they were in Milan, nice view

out the window of Milan there. And we called Joe Novak right away, who is our tech person, to make sure that the tech people were communicating with each other, and from my perspective it looked fine, but more importantly, from Joe's perspective it works well. So that's what we will be able to do.

At 10:30 tomorrow then, Dr. Ficetola, maybe that's not quite right, but he will appear on the screen. His direct will take -- wherever we are, we're going to have to interrupt whatever we are doing to accommodate that. I think that's 4:30 in the afternoon Italy time so it will work pretty well for him too I think.

So with that piece of business out of the way then, I'll grant the motion and that's what we will do tomorrow, okay?

Anything else you guys want to take up preliminarily this morning?

MR. RIESER: Your Honor, excuse me, David Rieser for the Coalition. Both myself and Mr. Krauskopf had motions with respect to the witnesses that are being proffered by the states.

THE COURT: Okay. Well, let me give you my two cents worth on that then.

MR. RIESER: Thank you, your Honor.

THE COURT: Let me ask first of all, are you going to call both those witnesses or just Dr. Lodge? That was a

little unclear to me.

MR. REICHEL: Just Dr. Lodge, your Honor.

THE COURT: Okay, very good. So with respect to Dr. Newcomb, obviously, she still has an affidavit and that's something that I will address in a second here.

Okay, I think I previewed this a bit here, but I have looked at the motions pretty carefully and the responses and replies. I'm going to read you an excerpt from a Seventh Circuit opinion.

"When the gatekeeper and the fact finder are one and the same, that is, the judge, the need to make such decisions prior to hearing the testimony is lessened. That is not to say that the scientific reliability requirement is lessened in such situations. The point is only if the court can hear the evidence and can make its reliability determination during, rather than in advance of, the trial.

"Thus, when the fact finder and gatekeeper are the same, the court does not error in admitting the evidence subject to the ability later to exclude it or disregard it if it turns out not to meet the standard of reliability established in Rule 702." That's In Re Salem. It's a Seventh Circuit case from 2006. I think that's an opinion by Judge Wood.

I have followed that opinion in the past in bench trial situations, and I think if that applies in a bench trial a fortiori it would apply in a preliminary injunction setting.

That's not -- I have looked at the motions carefully, and I have looked at Dr. Lodge's affidavit. Now, I'm aware that the affidavit that Dr. Lodge submitted was nine months old, and I'm assuming that what he is going to say today will be an update on his research and his conclusions. There isn't any question that Dr. Lodge is qualified as an expert in this area, and no one is saying to the contrary. I think essentially what the purport of the motion is that the science is under developed and that under the traditional Daubert criteria, testability, rate of error, general acceptance, it's at least the position of the movant that it's not up to standard.

And I think the question for the court then is whether notwithstanding the fact that it hasn't been tested by others and it may not have been peer reviewed, and maybe we will learn more about that today, but none of those things are, as I have written in a prior opinion, the sine qua non, the Seventh Circuit basically says, and the Supreme Court has said in the Kumho Tire opinion, that those factors are useful and the court ought to look at them, but if there are other indicia of reliability, the court can find that the opinion is reliable on that basis as well.

I think certainly when Dr. Lodge was initially retained in this -- it's not even this dispute, to study this matter, he was retained by the Army Corps of Engineers, and there have

been various statements by the Army Corps of Engineers, and I understand the context isn't quite the same as a peer reviewed journal, but various statements by the Army Corps of Engineers that have expressed some confidence in his work.

Whether the work at the end of the day satisfies the reliability and relevance standards is something I'll just have to sort out after I hear it, and that's particularly true because the affidavit is nine months old and I assume there will be something more to it.

So I think -- and I don't think this should come as a surprise to all of you who were in court last week, but essentially, I'm going to take advantage of the Seventh Circuit's guidance here that in a bench trial or a preliminary injunction or any setting where you don't have a jury, the judge can hear it and then decide later.

I'm certainly cognizant of the Daubert standard. That's a big part of what I did in practice at Mayer Brown is write Daubert motions, and I'm very comfortable applying it, and the case where I previously followed this pattern was a bench trial, and after the bench trial I credited some of it and disregarded other parts of it, but I think the only way I'm going to be able to intelligently do that in this case with respect to Dr. Lodge is hear his testimony and then sort it out later.

So that's how we will proceed today, is that Dr. Lodge

will be allowed to testify, he will be subject to cross-examination, and I will reserve the right later to disregard anything that doesn't meet the Rule 702 standard.

And since Dr. Newcomb is not going to be called as a witness then, I'll just sort that out later. I will comment, though, that there were some things in Dr. Newcomb's affidavit that probably went beyond her area of expertise. Certainly, Rule 703 allows experts to rely on other people's work, and what often happens in that case is you will read a body of literature and you will synthesize that, filtering it through your own scientific knowledge, expertise, experience, whatever the case may be.

My understanding is Dr. Newcomb is not a biologist, but she has a PhD, and so to the extent -- is she a biologist?

MR. REICHEL: (Nodding head).

THE COURT: She is a biologist, so that's what it means to have a PhD in that field.

MR. REICHEL: That's correct, your Honor.

THE COURT: Okay, but she has not done extensive work on eDNA, for example.

MR. REICHEL: No, that's correct. We haven't asserted that.

THE COURT: And I think -- that's right. So I think what I need to do is look at the various conclusions that she purports to draw by filtering the various materials that she

has read, some of which I haven't read, but are in the record, and determine for myself whether the opinion that she is purporting to offer rests on some sort of knowledge that she possesses. And obviously, I'll study her CV, I'll study the various connective reasoning that she uses to draw those conclusions, and I can sort all that out again with the benefit of the briefing that I already have. Okay, good enough?

MR. RIESER: Thank you, your Honor.

THE COURT: Okay, thank you.

So I think we're ready to proceed then, Mr. Reichel.

MR. REICHEL: Thank you, your Honor.

THE COURT: And just for planning purposes, I think we will go to about 12:30 today. I don't know how many of you guys, you know, what time you all got here, what time you all had breakfast, but I think for those of us who had the rest of the call this morning, I think that will be a good point to stop.

We will only break for an hour, and then we will carry on, we will pick from wherever we are with Dr. Lodge, and if we are done with Dr. Lodge, we will go to the next witness, okay?

And my understanding, Ms. Rudolph, your witnesses are not available until tomorrow?

MS. RUDOLPH: No, that is not correct, your Honor.

THE COURT: Oh, you do have some?

MS. RUDOLPH: Correct.

THE COURT: Okay, fantastic. Then we'll proceed -- you guys will have to work out how to order the defense case. The only thing I'm going to dictate is that the guy from Italy comes on at 10:30 tomorrow morning, okay?

MS. RUDOLPH: Very well.

THE COURT: Okay, Mr. Reichel, the floor is yours, sir.

MR. REICHEL: Thank you, your Honor.

As the court noted, the plaintiffs have submitted a number of written materials, exhibits in support of our initial motion, as well as some supplemental materials in support of our reply. And they include, among other things, as the court has noted, actually two affidavits from Dr. Tammy Newcomb, who is a fisheries biologist, and again, I'm not going to repeat what's stated in her affidavit, but her affidavit addresses a variety of topics, including the biological characteristics of these fish, the characteristics of the Great Lakes ecosystem, and the threat that Dr. Newcomb concludes that the potential migration that these fish pose to aquatic and other resources of the Great Lakes. And she also addresses, based upon her professional training and experience, certain specific recommendations as to measures to address that threat.

She has, because her affidavits are, were prepared quite

recently, they cover the substance of the testimony that we would offer if we were to call her as a witness here.

So given the court's stated and understandable preference not to have people merely call their affiants and have them repeat what they have said in writing, we have concluded that it's not essential to present her testimony live.

THE COURT: Okay. I appreciate that, Mr. Reichel, and I hope that everybody else heard what he just said because I don't want people repeating their affidavits. That's not going to help me. I have read the affidavits, I have the affidavits, I can continue to read the affidavits, but I appreciate that judgment call on your part, sir.

MR. REICHEL: Thank you, your Honor. And again, just similarly, we have also submitted two affidavits from Dr. John Taylor of Wayne State University, who has expertise in logistics supply change management, has done some reviews of transportation related economic impacts of some aspects of the relief that plaintiffs are seeking here particularly as they relate to temporary closure of locks in the area.

So for purposes of today's hearing, we, as the court is already aware, we want to supplement the written submissions with the testimony of Dr. David lodge, who as the court has already noted, you have had an opportunity to review the affidavit or declaration that was submitted on the same subject several months ago on behalf of the United States in

the Supreme Court, and as the court has anticipated, there have been further factual developments since that time, which would be among the primary subjects of what we expect his testimony to include here this morning as well as to address some of the issues that have arisen specifically in the course of this litigation as they relate to questions about the scientific reliability of the methods that he and his team have employed involving environmental DNA, or eDNA, as well as what inferences may or may not be scientifically legitimate from those data.

So that is why we are presenting here today, and for that reason we have subpoenaed Dr. Lodge. Just to be clear, neither the State of Michigan nor the other plaintiffs have retained him, but we have subpoenaed him to ask him to testify or to require him to testify here today.

So with that, the plaintiffs would call Dr. David Lodge.

THE COURT: Okay, very good. And just before Dr. Lodge comes up, Exhibit 14 is his prior affidavit that was submitted to the Supreme Court not by you.

MR. REICHEL: That's correct.

THE COURT: And Exhibit 21 I think is the other one I looked at, which was an excerpt of his testimony before a congressional committee?

MR. REICHEL: That's correct, your Honor.

THE COURT: Okay, and that's what I have got in the

record previously stated from Dr. Lodge?

MR. REICHEL: Yes.

THE COURT: Okay, very good. I just wanted to make sure that I had covered the whole nine yards, at least as I could have before today.

MR. REICHEL: That is exactly correct, your Honor.

THE COURT: Okay, very good. So, Dr. Lodge, I see Dr. Lodge, he can come forward.

MR. REICHEL: Thank you, your Honor.

THE COURT: Go ahead, Mr. Reichel.

And when you get up here, if you could just remain standing for a second and Lois will swear you in, okay?

(Witness sworn)

THE COURT: Thank you, please be seated.

Before you start, I will remind everybody that I apprised you at the very beginning of this litigation that I know Dr. Lodge and the circumstances by which I was acquainted with Dr. Lodge, and as I said before, I don't think it has any bearing on my ability to judge him impartially, but no one has said anything to the contrary, so I'm comfortable proceeding.

MR. REICHEL: Thank you, your Honor.

THE COURT: Go ahead, Mr. Reichel.

DAVID M. LODGE, PLAINTIFFS' WITNESS, DULY SWORN.

DIRECT EXAMINATION

BY MR. REICHEL:

Q. Dr. Lodge, could you please state your full name for the record.
A. My name is David Michael lodge.
Q. Just to confirm what I apprised the court, you were served with a subpoena requiring you to testify here today by our office, is that correct?
A. That's correct.
Q. And again, has either the State of Michigan or any of the co plaintiff states, have they retained you or hired you as an expert in this matter?
A. No.
Q. Dr. Lodge, some of this material is already stated in your affidavit. For purposes of continuity, I would like to briefly review a few things.
Could you first describe what your educational background is, sir?
A. I have a DPhil, which is the Oxford University's equivalent of a PhD, which I earned in 1985, and I served two and a half years after that as a postdoctoral research fellow at the University of Wisconsin and subsequently became an assistant professor at the University of Notre Dame, where I have been ever since subsequently being promoted to associate and then full professor.
Q. So you are by training a biologist, sir, is that correct?

A. My training is as a biologist, as an ecologist, in particular and I have done extensive research over the years essentially since my professional career began on invasive species in particular and aquatic ecosystems.

Q. And during the course of your scientific career, have you published any articles in peer reviewed journals?

A. I have published along with many collaborators and co-authors on the order of at least 150 articles.

Q. Have you published any books dealing with, among other things, invasive species?

A. I have edited and contributed to at least an edited volume of a journal and two books that dealt with environmental issues broadly, and in particular the most recent book to which I contributed and edited was on the economics and ecology of invasive species. That book was published by Oxford University Press.

Q. And you're currently a professor at the University of Notre Dame, and I see that you're associated with something called the Center for Aquatic Conservation. Can you explain what that is?

A. That's a center that the University of Notre Dame established just a few years ago, on the order of four years ago, in order to put my colleagues and I at the University of Notre Dame in a better position to be doing research that would inform urgent and important natural resource management

and policy issues.

Part of the forming of that center was to encourage partnerships with external organizations, including government agencies, non-governmental organizations, and other relevant stake holders and parties including the private sector.

Q. And is there also -- do you supervise a laboratory at the University of Notre Dame?

A. So I, yes, also like all active scientists, I have a laboratory that includes a number of graduate students and post docs and research assistant professors and undergraduate researchers, technicians, and so forth.

Q. Going back to the year 2008, Dr. Lodge, did you have occasion to enter into a cooperative agreement with the United States Army Corps of Engineers, that is, either you or I should say the Center for Aquatic Conservation?

A. Yes, I led us in a collaboration that was formalized ultimately in 2008 as a cooperative agreement using as a vehicle for funding something called a Cooperative Ecosystem Studies Unit by which the U.S. Army Corps of Engineers provided financial support for the research that we have been working on and that has developed over time.

Q. Were you, were you or your team given funding to assess the risks of the transfer of invasive species through the Chicago Sanitary and Ship Canal?

MR. RIESER: I'm sorry, we are having a lot of trouble

hearing Dr. Lodge on this side of the room. I'm hoping he can keep his voice up.

THE COURT: Okay, thank you for pointing that out.

MR. RIESER: I'm sorry for interrupting.

THE COURT: No, that's okay, it's important that everybody be able to hear. Dr. Lodge, maybe you could -- I'm not sure, our sound system in this room gives us fits all the time, but if you could maybe talk a little louder, that might be helpful. Thank you.

THE WITNESS: I have been told I mumble.

THE COURT: Okay, very good.

BY MR. REICHEL:

Q. Would you like me to repeat the question, Doctor?

A. Please.

Q. My question was did you or our team at the Center for Aquatic Conservation, were you asked to do an assessment of the risks of transfer of invasive species through the Chicago Sanitary & Ship Canal?

A. Yes, through a series of conversations with representatives of the Army Corps of Engineers, we arrived at a set of topics that, that centered around risk assessments of species movement through the Chicago Sanitary & Ship Canal. We, through this series of conversations we identified areas of interest to the Army Corps of Engineers to which we had relevant expertise, and initially that was focused on a broad

assessment of which species might move not only northward but also southward through the Canal and therefore might pose an economic or environmental or human health risk to either the Great Lakes Basin or the Mississippi Basin.

Q. And from that initial focus did you and your team in your cooperative agreement with the Corps, were you asked to look at or assess the threat posed by the dispersal of bighead and silver carp through the Chicago Sanitary & Ship Canal?

A. Yes, that was one component of the work that we originally outlined and became over time more and more of focus because it was of urgent interest to the Army Corps of Engineers, but originally, it was one of many species that we were looking at.

Q. Just to put this in context, Dr. Lodge, we have projected up on the screen here a map. Are you familiar with this map?

A. Yes, that map was constructed from preexisting maps by our collaborators at the Nature Conservancy.

Q. Let me just pause you there. I have asked you about your collaborators. You have mentioned that you work with a group of other scientists. Let me ask you now specifically about the work that you began doing in 2008 in connection with the Corps.

Could you identify for the court the team that worked with you on this project?

A. There have been four principal leaders of our efforts of research since 2008 in collaboration with the Army Corps of Engineers. Besides me, the other three collaborators are Dr. Christopher Jerde, who has a PhD in biology and is a specialist in statistics and data analysis and modeling of species dispersal.

The second person who became more and more involved as the research developed toward the eDNA direction is Dr. Andrew Mahon, who has a PhD in biology and also postdoctoral research experience. Both Dr. Jerde and Dr. Mahon have published extensively in their areas of expertise. And the fourth member of the team is Lindsey Chadderton, Mr. Lindsey Chadderton, who is the Director for Aquatic Species Research in the Nature Conservancy. He comes from a background of managing invasions and surveillance of invasions, particularly a rich experience working for the Department of Conservation in New Zealand.

Q. And again, so just to put this, directing your attention again to this first image that we have up on the screen, does this depict the general spatial location of the Chicago Sanitary Ship Canal or what is sometimes referred to as the Chicago Area Waterway System?

A. Yes. We typically refer to this whole system as the Chicago Area Waterway System. Different parts of it go by different names by different people. So it can be confusing

as we talk about different parts of it, but yes.

Q. Okay. And so you indicated earlier that one of the tasks that you were asked to -- that you undertook to work with the Corps on was identifying species, not specifically Asian carp, or I should say bighead carp and silver carp, identifying species that have the potential or the risk of dispersing either northward or southward through this waterway system?

A. Yes.

Q. And did you or your colleagues eventually provide the Corps with a list of maybe some of those species that you believe presented that risk?

A. Yes, through a series of discussions with representatives of the research arm of the Corps and the Chicago District and others in the Corps, we collaboratively decided how to conduct that risk assessment, how to come up with a list of species, and how to begin to do a preliminary risk assessment of those species that could either move northward or southward through the canal with a particular focus on, on the electric barriers and the mechanisms and approaches that the Corps and others have taken to prevent movement. Only later did we begin to focus on bighead and silver carp.

Q. Turning to bighead carp and silver carp specifically, which I may, just so you're clear about the

terminology I'm using, if I refer to Asian carp in my questions, I would like you to understand that to refer to bighead carp and silver carp.

A. Yes, understood.

Q. Thank you. With respect to these Asian carp species, did you or your colleagues attempt to model or to assess the rate at which those species were dispersing through the Illinois waters that are connected to the Chicago Area Waterway System?

A. Yes. We were prompted to model the dispersal or statistically analyze the dispersal of Asian carp northward through the river and canal system by a series of discussions and meetings that we had with the Army Corps of Engineers and other management agencies involved when in the course of those discussions it became clear that there was some sense that the invasions by these species had stalled going northward.

So we were prompted to investigate more carefully what the evidence was or was not for the rate of spread of these species northward.

Q. Okay. Now, with respect to dispersal, modeling dispersal, what sort of data did you and your colleagues look at in trying to assess that?

A. We used primarily the data that is publicly available on the USGS, that is, the United States Geological Survey web site, which includes records for the occurrence of

many invasive species throughout North America. So that's primarily what we used and then augmented those data as possible with the sitings of individuals of Asian carp as they occurred in the recent past.

Q. Just for clarity, I'm putting up in the course of this testimony some demonstrative exhibits. We have had some copies made. I'm going to ask my co-counsel to distribute them to other counsel in case they can't see the screen here.

THE COURT: Okay,that's terrific, and anybody who does want to see the screen, you're welcome to move in a position that you can.

BY MR. REICHEL:

Q. Dr. Lodge, do you recognize this image that's displayed on the projector here?

A. Yes, the graph on the right is identical to a graph which we put in a report to the Army Corps of Engineers that summarized our initial study of risk assessment of species moving through the Chicago Sanitary & Ship Canal.

The only differences between this and the figure that appeared in the report were simply improvements to make it more legible for presentations that I have given over the last year or so.

Q. And again, if I understand your testimony, this, what you and your colleagues did was start with data or databases of actual observation of these species in the

environment and in this case in the Illinois River systems?

A. Yes. So on that graph, for example, the vertical axis is the typical used measurement for navigation or other analyses involving the river miles, those would be the miles that a fish would have to swim or a barge would have to navigate in order to get from point to point.

The horizontal dash lines are different control structures in the canal. And the dark dots represent the known most northward locations of bighead carp and the grey dots the same thing for silver carp, again, as recorded by the USGS in their publicly available online data set. The upper dots for both species include or are based on more recent data from the management agencies' efforts in the very recent past to capture and see fish in the waterway.

Q. And could you explain to the court what those lines are that you and your colleagues have placed there?

A. Those lines are regression lines, just the result of a very, very standard statistical approach to trying to take a collection of information, the occurrence of fish in this case, and our purpose is to see whether there appears to be a continuous, an apparently continuous dispersal or movement of the fish northward or whether in fact there is any evidence that the movement northward is punctuated in time and space.

Q. And I believe you testified just a moment ago, when you say "punctuated," you indicated in the discussions that

you and your colleagues have had with representatives at the Corps, some had expressed the view that the progress or invasion of these species northward through the Illinois River systems had stalled, was that the correct term?

A. Yes, in a number of the meetings of various committees and discussions that have been ongoing about the Canal and the barrier and which we became a part of as we engaged in this research with the Corps, we heard a lot of discussion about invasions having stalled, and the importance of that was that it led to a sense of, that there didn't need to be so much concern about where the carp were because they seemed to be stalled south, considerably south of the electric barrier, so we felt it was important to assess the nature of the evidence in support of that apparently widespread belief, and that's what prompted us to do this analysis, which shows clearly that there is no evidence of any stalling of the invasion.

Q. Okay. And directing your attention to the left-hand side near the bottom, there are the words "bighead and silver carp likely at electric barrier less than or equal to 2007 to 2008." Could you explain what you mean by that?

A. What I mean by that is if you look, take the opportunity to point at this little line up here, that says "electric barrier," that's the location of the electric barrier so one of the specific questions we were trying to

address here was when would bighead and silver carp likely have been at the barrier.

And you can see that those two lines cross that electric barrier dashed line for bighead carp around 2007 and for silver carp around 2008, suggesting that the carp were likely or there is, the evidence as it exists suggests that the carp would have been, if you will, testing the electric barrier earlier than had previously been assumed.

Q. Dr. Lodge, based on your professional training and experience as a biologist, are you familiar with the methods that are commonly or traditionally used by biologists or management agencies to assess or determine the presence of fish?

A. Yes, I have worked in a variety of research projects over my career that involved fish. We have employed in various research projects and published information using nets and electroshocking and other tools, have collaborated on other projects where those tools were part of the ongoing and day-to-day tools being used, so I'm very familiar with the standard fisheries research tools.

Q. And based upon your training and experience as a biologist and the knowledge that you may have gained about these particular species of Asian carp, what is your understanding of the ability of the conventional methods that you have just described, that is, netting and electroshocking,

the ability or sensitivity of those detection tools in determining the presence of these species near the leading edge of a so-called invasion front?

A. First of all, those, those fisheries biologists who have extensive field experience working particularly with these species, which I do not, but those biologists who do have such experience, and I'm thinking, for example, of Dwayne Chapman with the USGS, have repeatedly pointed out that these fishes, both silver and bighead carp are particularly difficult to catch with traditional tools.

I think more -- equally important is the fact that the traditional tools, electrofishing and netting, even with extensive efforts, even with extraordinary efforts, catch only a small proportion of even fish that are easy to catch.

If we look at one particular published study recently, a study done by Greg Sass and colleagues published in 2010 in the Journal of Biological Invasions, it's one of the few studies in which there has been an attempt to do a mark recapture study of Asian carp. A mark-recapture study is a standard long used tool to try to estimate population size.

For purposes of answering this question, though, the important thing about the Greg Sass, et al. study is that they devoted extraordinary efforts to catch fish in the LaGrange pool of the Illinois River and were only be able to capture less than 1 percent of the carp that they estimate were in the

pool.

So an important message here is that the traditional tools even when they're employed with considerable effort will catch at best a very small proportion of the fish present in a waterway. That's true for any fish. It's especially true for Asian carp.

Q. In light of that fact, Dr. Lodge, and given the fact that in your collaboration with the Corps of Engineers you were being asked to assess the risk of their migration, if you will, through the Chicago Sanitary & Ship Canal, what action did you and your colleagues take to address the limitations on these traditional sampling methods?

A. Well, we certainly in discussion about how the surveillance programs could be improved, I mean, we first pointed out that in fact the effort that was being devoted by the management agencies with traditional tools was focused in areas where the fish were already known to exist, whereas if you're really trying to design a surveillance program to detect the invasion front, that is, the leading edge of an invasion, one should be putting more effort with whatever tools you have, be putting that effort more in advance of where you know they are if the goal, as it was, was to detect the invasion front.

So first was just simply providing advice based on experience to shift the effort of traditional tools further

north, not to devote as much effort as was being devoted to areas where the fish already occurred, where everyone agreed the fish already occurred.

Secondly, we proposed, after conducting a series of preliminary trials in my laboratory at Notre Dame, we proposed the use of sampling water and detecting DNA of the fishes in the water as a possibly more sensitive tool to detect the presence of both silver and bighead carp.

Q. On that score, Dr. Lodge, before we get into that, and I'll have a number of questions about the environmental DNA method, but more generally speaking, in your experience as a biologist, are there other situations that you're aware of where scientists have used samples of genetic material in the environment, collected from the environment as a means of trying to indirectly or directly detect the presence of particular species?

A. There is an increasingly rich literature and history of using what is variously called indirect DNA based methods or environmental DNA methods or a variety of other terms, but there is a rich history of literature for 20 years or more on using techniques to collect not the organisms themselves but rather what the organisms leave behind and using DNA to ascertain which species that left behind material came from.

Q. Dr. Lodge, I have just put up, so the record reflects, I just put another diagram on the projector here for

demonstrative purposes. Can you tell the court what this is?

A. So these are just two examples of recent studies demonstrating the usefulness of indirect methods based on DNA of ascertaining the presence of organisms.

The paper on the bottom is a review paper. By that what a scientist means is that this is a study not based on primary data collection, but rather a paper which synthesizes previously published papers to integrate what has been learned to -- and to point the way toward future advances.

So this is a particularly valuable paper recently published, 2009, as it says up there, which includes a table which summarizes a large number of examples of studies which have used these indirect DNA based methods to detect the presence of organisms, organisms from most of the applications for terrestrial organisms, but there are several for aquatic organisms.

One of the papers that is covered in that review paper is the paper listed at the top of that slide, the paper by Ficetola, et al. That paper by Ficetola and co-authors published in 2008 is the paper which was the immediate impetus for our ideas about using indirect DNA based methods to detect the occurrence of Asian carp in the Chicago Area Waterway. So that paper describes a successful application of the technique which we then later had the opportunity to employ in the Chicago Area Waterway.

Q. Dr. Lodge, as was noted earlier, several months ago you prepared and signed a declaration, a sworn statement, a statement that was filed on behalf of the United States in another piece of litigation in the Supreme Court where you talked about some of the work that you had done, do you recall that?

A. Yes.

Q. And I believe in that statement you characterized the, your team's use of environmental DNA as a means of detecting the presence of so-called Asian carp as novel. Do you recall saying that?

A. Yes, I have referred to it as novel.

Q. Could you explain what you mean by that and in what sense is it novel?

A. It's novel in the sense of almost any published scientific paper which reflects an incremental improvement in established methods. It's novel, specifically in our case it's novel because we altered slightly the techniques that Ficetola and his co-authors used in order to be able to sample larger volumes of water over a much more extensive geographic area appropriate to the questions in the Chicago Area Waterway than the question on which Ficetola and his co-authors focused.

Q. Apparently, the court will have the opportunity to hear testimony by Dr. Ficetola, but just in the interest of

continuity, could you briefly describe for the court, you don't need to go into great detail, but the nature of the research that Dr. Ficetola and his co-authors did, I mean, what the setting was, what species they were looking for?

A. Ficetola is -- from what I can gather from his paper, Ficetola and his co-authors were interested in just testing the feasibility of using these indirect DNA based methods to detect bullfrogs, American bullfrogs, which are an invasive species in France. To do that they took advantage of apparently preexisting information about a variety of ponds in which bullfrogs, some of which bullfrogs occurred in abundance, some of which they were quite confident the bullfrogs didn't occur, and in between.

So nine ponds, a gradient of bullfrog abundance, they took three samples of water, 15 milliliters each, rather a small sample compared to what we did later in the Chicago area waterway. They extracted all the DNA from that 15 milliliters of water without any filtration and then used standard tools, as we have done, to detect the presence in their case of DNA from American bullfrogs.

Q. And so how did the approach that you and your colleagues developed in this setting with respect to Asian carp, how did that differ from the approach taken by Ficetola and his colleagues?

A. There are several differences, all of which I would

regard as incremental either improvements or just adaptations for the different question and scale on which we were working.

Again Ficetola, et al., took a very small number of samples, 15 -- a small number of small volume samples, we have taken a very large number over the last couple of years of 2-liter samples of water.

In order to manageably extract the DNA from such large sample volumes as we are using, we have filtered the water. Ficetola did not filter the water. Again, I regard that as a relatively minor change. And we also have adopted a whole battery of quality assurance/quality control approaches in our approach that are not mentioned in Ficetola's paper. We have done that because of the importance and management relevance of the work that we were doing. There are some other changes.

Q. No, that's fine, I just wanted in a general sense.

I have another demonstrative slide, this one headed Procedures For eDNA Analysis. Do you know who prepared this, Dr. Lodge?

A. Yes, this is a simple schematic that we have used in many presentations over the last couple years to communicate the general approach that we are using in what we referred to as eDNA.

Q. Before we go on to -- this is a series of steps, I think this has been discussed before, but just so the record is clear, in the case of Ficetola and his colleagues looking

for evidence of American bullfrogs or in the case of you and your team looking for evidence of Asian carp, what -- how is it, I mean, if the organism in question is not physically present at the time the sample is collected, how is its genetic material ending up in the environment or in the water column?

A. In the same way that forensic scientists are using the DNA left behind by humans, criminal suspects, for example, in many situations we are using that same approach with the understanding that all organisms to some degree or another leave some DNA behind in sloughed off tissue.

In the case of Asian carp, we suspect perhaps the most important source of DNA might be in cells from the intestinal lining which are shed with feces from the fishes, could be in the slime of the fishes, could be in tissues in fast turnover, tissue in the gill. Regardless of where it comes from, it is no surprise that DNA is left behind by organisms.

Again, if we go back to that review paper from Beja-Pereira in 2009, there is this long history of taking advantage of the fact that organisms leave bits of tissue behind from which at least for a time DNA persists and is detectable using standard tools such as we have used.

Q. Okay, and just walking through this, you have already explained that you and your colleagues collect a water sample of 2 liters, is that correct?

A. We have relied on the arbitrarily determined volume of 2-liter samples.

Q. And then you talked about filtering. Is that just to collect the genetic material if it's present?

A. That is the collect the particular material, which will contain DNA if there are cells from the target organisms present or if there is DNA which has adsorbed or adhered to particulate matter in the water.

That is a point of difference with what Ficetola, et al. did. They extracted DNA from the entire water sample so conceivably they were extracting more DNA than was present in a water sample than we are for a given volume.

Q. What's the next step?

A. The next step there is simply to extract all the DNA that was trapped on the filters that we used.

Q. And the technique that you and your colleagues used in that regard, is that one that is to your knowledge and your colleagues' knowledge, is that one that's commonly employed by scientists working in this area?

A. Aquatic scientists use filters all the time for a variety of purposes. There is nothing special about the filters we have used or the techniques we have used to filter except that we have been extraordinarily careful to avoid contamination.

Q. And the next step?

A. The next step is using polymerase chain reaction, commonly abbreviated PCR. This is a standard molecular biology tool. It has been standard for about 20 years, discovered by Kary Mullis in 1983 and adopted very rapidly and is used by every molecular biology laboratory on the planet for a variety of purposes.

In our, for our goals we have used it to duplicate or multiply any copies of DNA from either silver or bighead carp in our sample.

Q. And why are you doing that?

A. So we are doing that because this increases our ability to detect whether, if there is DNA from either silver or bighead carp in the sample that was trapped on the filter, we multiply the numbers of that so that it becomes abundant enough to detect.

Q. Detect in the sense of what, comparing it to other known references?

A. Detect in the sense of, with -- yes, with standard samples, with positive controls, which we use routinely, and with respect to -- well, yes, I mean, that's the best I can say.

Q. And again, use PCR with species specific primers, I expect the court is going to hear other testimony and discussion about the term "primer," so in the interest of being clear on this, could you explain to the court in this

context what you mean and you understand the term "primer" to mean?

A. In the standard use of PCR, which is what we have done, one of the ingredients in a PCR reaction is primers, one what is referred to as a forward primer, one a backward primer, one applies to each strand of double-stranded DNA.

So you have to have two primers, one forward, one backward to start a reaction which duplicates any DNA from silver or bighead carp which would be present. Primers are designed to be species specific.

Q. So in other words, there would be a primer that would be specific to bighead carp?

A. Yes, that is, any DNA that is duplicated in a PCR reaction with the primers that we have chosen will be DNA only from the target species, either in our case silver carp for one set of primers or bighead carp for a different set of primers.

Q. Are primers set up or designed, as you have said, in a way that they will in effect target, if that's the right term or amplify, enable you to amplify genetic material of a certain size or length?

A. Yes, the primers, the combination of these two primers for each species, one forward primer, one backward primer ends up if there is any DNA from the target species present, it will duplicate a certain fragment of that DNA,

again, if such fragment is present to begin with. It will just make more copies of it.

That fragment, which is duplicated and which you end up with many copies of at the end of the PCR reaction, is longer than the primers. So in our case, our primers were designed to duplicate in a PCR reaction a fragment of DNA, which we routinely refer to as a marker or a diagnostic fragment of DNA, of about 200 base pairs in length for silver carp and about 300 base pairs in length for bighead carp.

Q. Without getting too much into the technical detail, when you talk about base pairs, is that a commonly understood term among geneticists or people who are working with this?

A. That is everyday parlance for any molecular biologist.

Q. Okay. And again, there may be further testimony on this subject, you have mentioned that your methods were set for markers of a particular length for those two species. When you reviewed, Doctor, the paper published by Ficetola and his colleagues, did they identify what marker length or what fragment of genetic material from the American bullfrogs they were targeting?

A. In their paper they identify their primers, they provide a description of the primers, just a sequence of As and Ts, and they state in their paper that the fragment that is duplicated, this species specific fragment of in their case

bullfrog DNA that is duplicated was, 79 base pairs in length.

Q. So in other words, the fragments that were targeted by the work, the tests that you and your colleagues did, were actually longer than those that Dr. Ficetola and his colleagues did in the species that they studied, is that correct?

A. Yes, Ficetola's 79 base pairs compared to our length for silver of about 200 base pairs and for bighead about 300 base pairs.

Q. So as you -- you have described earlier that you and your colleagues looked at the application of these techniques to the detection, of indirect detection of bighead and silver carp. Again, this work that you just described, was that, when was that developed, in 2009 or 2008 approximately?

A. Our development of these primers and the species specific DNA fragments that those primers duplicate was done I believe beginning in late 2008 and then first formally proposed to the Army Corps, if I remember correctly, in early 2009.

Q. And as you adapted and refined this method for that purpose, could you -- how, did you start in the field, did you start in the laboratory? Could you briefly describe the principal steps you and your colleagues used in adapting this method?

A. Yes. Before ever proposing this to the Army Corps

of Engineers, we wanted to gain some confidence that it would in fact work. So we started in the laboratory with a variety of simple experiments, putting fish in containers in the laboratory, seeing how long they had to be there before we could detect DNA, seeing how long that DNA hung around after we took the fish out, working, originally not with silver and bighead carps but with common carps or other species just as surrogates.

And then once we gained confidence from those laboratory experiments that we could make -- the sort of approach that Ficetola, et al. had prompted us to think about to make that work, we then did, took some samples from real aquatic environments including local rivers and ponds and ultimately including parts of the Illinois waterway to see whether we could make it work specifically with silver carp and bighead carp, which we could, and at that point we proposed it formally to the Army Corps as a potentially very sensitive new tool in their surveillance toolbox.

Q. Okay. And I think as the court is aware, ultimately the Corps provided you and your colleagues funding to actually implement the use of this method in the field, is that correct?

A. Yes, the Corps has provided several additions to our original cooperative agreement referred to typically as modifications of that original agreement to add resources in

order to expand the research, for example, in this case to include environmental DNA surveillance.

Q. And we will get into this in more detail, but since you implemented, you and your colleagues implemented this method, am I correct in understanding you provided a series of reports to the Corps about, as the work progressed?

A. We provided very regular reports, written reports, for long stretches of time during our collaboration with the Corps on a weekly basis. In addition, we provided more frequent and informal, but written reports via e-mail whenever we got a result which was particularly -- well, when we got positive results we let the Corps know immediately.

Q. And in addition to those periodic or interim reports, did you and your colleagues ultimately prepare a report summarizing -- I want to go back to the original scope of work that you had, that is, where you were asked to do this risk assessment of invasive species.

Did you and your colleagues put together a report addressing that and summarizing the other work that you had done to date?

A. Yes, the original scope of work, we summarized our progress toward accomplishing those goals in a report which I believe we provided a first draft of to the Corps, I believe it was in April, 2009, and provided the Corps an opportunity to provide feedback and reactions to that, with the eye that

we would revise it then to become a final report, which we did and submitted that in July to the Corps.

Q. Dr. Lodge, a moment ago you said 2009. Did you mean 2009?

A. I meant 2010, thank you.

MR. LODGE: Your Honor, may I approach?

THE COURT: Sure.

BY MR. REICHEL:

Q. Dr. Lodge, I'm handing you a copy of what we have marked for identification as Plaintiff's Proposed Exhibit No. 1. Can you identify what that is, please?

A. Yes, this is the report that we were just referring to.

Q. Which has the heading Aquatic Invasive Species Risk Assessment for the Chicago Sanitary & Ship Canal, is that correct?

A. Yes.

Q. And were you one of the principal authors of this report?

A. Yes, this was very much, though, a collaborative effort, as the list of authors indicates. Dr. Christopher Jerde led our efforts, led the work of our team toward compiling this report and was very much involved in different aspects of it. Matthew Barnes is a graduate student in my laboratory. Joanna McNulty is the program coordinator. I

referred to Dr. Andrew Mahon earlier. He has published many papers on molecular biology. Mr. Chadderton I referred to earlier, and myself.

Q. Directing your attention to the table of contents, I'm not going to ask you to go through the entire document, but this addresses under the heading (1) Risk Assessment of Species Moving Through the Chicago Sanitary & Ship Canal, as you discussed earlier, is that correct?

A. Yes.

Q. No.2 is Dispersal Modeling. Is that something you talked about earlier?

A. Yes, the core of that was the graph we looked at earlier.

Q. And the third heading is Preliminary Study of eDNA Surveillance. And again, does this relate to the method development that you just testified about in the last few minutes?

A. Yes, we developed this -- we did the experiments. The sort of preliminary experiments that I referred to earlier supported not only by the Army Corps of Engineers, the preliminary work that laid the foundation for the application of eDNA in the Chicago Waterway was supported by the cooperative agreement from the Army Corps of Engineers to which we have already referred and also by an ongoing project funded by the Great Lakes Protection Fund, which had

originally supported Andy Mahon's research in which we were developing other DNA-based tools to detect species in other contexts.

But carp were an interest in both projects and that other project provided us the financial support to develop the primers for the carp.

Q. And Dr. Lodge, you indicated that you're one of the co-authors of this report. To the best of your knowledge, sir, in terms of the substance of the information provided, does it or does it not accurately reflect, describe the work that you and your colleagues performed on these subjects?

A. It does, it does describe that work, although in looking at it recently, I did note that on Page 3 we have got the wrong dates at the bottom of the page, and as I said earlier, our final version of this report was provided in July of 2010.

Q. As opposed to May?

A. As opposed to May, which it says on Page 3.

Q. But other than that, to the best of your knowledge, this accurately describes the nature of the work that you did and reported to the Corps for what's covered by this?

A. Yes.

MR. REICHEL: Your Honor, at this time I would move for admission into evidence of this document as Plaintiff's Proposed Exhibit 1.

MS. RUDOLPH: No objection, your Honor.

THE COURT: Okay, very good. No objection across the board?

MR. RIESER: I think I'm going to have to reserve objection until we have had the opportunity A, to review it and B, to cross-examine Dr. Lodge regarding it.

THE COURT: Do I have a copy of this exhibit?

MR. REICHEL: No, you do not, your Honor. I wanted to move for its admission.

THE COURT: Okay, well, I will provisionally admit it subject to any objections later, but, you know, that's the advantage of a bench trial.

MR. REICHEL: Your Honor, may I approach?

THE COURT: Yes, certainly.

MR. REICHEL: I should have --

THE COURT: Thank you, sir.

MR. REICHEL: --mentioned earlier that this was not among the documents that was in the wealth of papers. In fact, it is publicly available in the sense that it was submitted by Dr. Lodge and his colleagues to the Corps. We only recently obtained a copy.

THE COURT: Okay. Well, fair enough. And as I say, I will provisionally admit it subject to any objections later that could be surfaced after people have had a chance to digest it, but for now you can carry on.

MR. REICHEL: Thank you, your Honor.

THE COURT: Thank you.

(Plaintiffs' Exhibit 1 received)

BY MR. REICHEL:

Q. So again, you have testified, Dr. Lodge, that you have provided over time from 2009 as you collected the field work, and I don't think you indicated how long that's continued, but you and your colleagues have collected numerous water samples from the Chicago Area Waterway System, is that correct?

A. At this point, and we are, we have now concluded, we believe, we have concluded our participation in the regular surveillance program in the Chicago Area Waterway. We have taken, I believe, on the order of 1,500 samples from the beginning through May of this year.

Q. And we will go into this in a little more detail in a moment, but with respect to the results of those samples that have been made available to the public, would the most recent sampling event or dates of the sampling have been in May of this year, is that correct?

A. Yes. Yes, with a qualification. We have -- we are in fact in the middle of completing analyses of another set of I believe on the order of 450 samples, which we agreed to take because there was not yet the capability in the Army Corps to pick up the regular surveillance program.

So we are still working through some samples collected I believe in June which were -- no, I'm sorry, it was not June, it was later than that, which were focused to the east of where we had previously taken samples because the agencies involved were keen to learn more about what was going on in the Calumet region and eastward from there.

So we still have some samples that we were working on in the interim before the Army Corps of Engineers itself picks up this surveillance program.

Q. While we are on that subject, I'm going to ask you to elaborate. Is it your understanding, Dr. Lodge, that it is the stated intention of the Corps to itself or have some third-party undertake future analyses, if any, of DNA samples for this project?

A. Well, one of the most recent modifications or additions to our cooperative agreement with the Corps was, had as its expressed purpose to transition the regular eDNA-based surveillance in the Chicago Area Waterway from our team at Notre Dame and the Nature Conservancy to the Army Corps of Engineers' Laboratory, Engineer Research and Development Center, ERDC, which is the U.S. Army Corps' laboratory in Vicksburg, Mississippi. They have a genetics group there which had early on expressed interest in learning how to do the tool and applying the tool.

So we are in a process of transitioning the eDNA

surveillance to the Army Corps of Engineers and that process, we adhered to that process and the agreement called for that process to be concluded earlier this summer.

Q. Are you aware of any laboratory other than your team to date actually having processed any samples collected from the Chicago Area Waterway System?

A. There is one other laboratory that just recently is beginning to take on, to learn how to do this, and that is a commercial laboratory based in South Bend. A new company has been set up to, to do this, and we have been cooperating with that company, and in fact, I am, full disclosure, a minor partner in such a company in order to develop the capability to apply this so that the incredible demand that we have had from various government agencies and private sector parties to do this work.

Q. Just to clarify -- go ahead, please.

A. Just to complete that answer, in addition, as part of a new Great Lakes Restoration initiative funded project, we are transitioning the ability to do this monitoring to any federal or state agency in the Great Lakes region that is interested, and we are in the early stages of transitioning the capability also to a U.S. Fish & wildlife laboratory in LaCrosse.

In addition, as part of this newly funded project, we will be training whichever state agencies in the Great Lakes

region want to do this, also to train them to do it. It is our purpose to be doing research to develop such tools, not to be in the routine surveillance business.

Q. Understood. But just to go back to this earlier point, you had indicated that it was your understanding that there was a plan in place to have an environmental or science laboratory associated with the Corps of Engineers itself undertake analysis of these samples, and my question specifically is to your knowledge, has that laboratory yet analyzed any such samples?

A. We have been through some of the steps of what we had described in scope of work as being the appropriate steps toward transitioning, that is sampling together, blind samples, comparing results, and so forth.

To date, that laboratory has not been able to consistently duplicate our work and has acknowledged a, to use their words, pernicious contamination issue.

Q. Let me turn now, we have talked a lot about the process here, but I would like to now talk about the results. There has been a good deal of focus on that. And we will go through some of the specific results that you and your colleagues have reported, but let me first ask you to explain -- I believe you testified earlier that when you do one of these tests and you do them for -- you do on a species specific basis, bighead, silver, correct? And so when you

report using your method a positive result, first of all, is that specific to one or the other of those species?

A. Yes.

Q. And given the method as you have developed it and applied it, what inference do you draw as a scientist from a positive result in one of these samples -- let's just use bighead as an example.

You have collected a sample from a water body, tested it and reports, you get a positive result for bighead carp eDNA. What inference do you as a scientist draw from that?

A. The most plausible inference to be derived from that is that in the not very distant past there has been at least one bighead carp present in the vicinity.

Q. When you say "the not very distant past," could you bracket that time wise?

A. Yes, based on some experiments that we have done both in the beginning before we ever proposed using DNA to the Corps and more recently from samples taken from the field, we have ascertained that the signal that we are detecting, the DNA sample that we are detecting disappears on the order of hours to at most a couple of days from a sample.

So when I say "in the not too distant past," what I mean is roughly a couple of days. A fish, I would infer that a fish has been present in the vicinity within a couple of days.

Q. And in -- go ahead, I'm sorry. Please, did you want

to complete that answer?

A. Well, one also has to take into account movement or the water, so to think about how much water would have moved in a couple of days, so that would be a further qualification.

Q. And so I believe you used a phrase -- in any event, you mean in the vicinity of where the sample was collected?

A. Yes, in the vicinity of where the sample was collected or where the water was at the time it was sampled. It is difficult, however, to, to detail further what I would mean by "in the vicinity" because we do not have -- we have not yet had the opportunity to do the experiments where one could really detect how far away, under what circumstances DNA from a fish might be detectable.

But given the rapidity with which the DNA sample degrades and is decomposed, the 2-day window, one can guess that the fish would not have been too far away.

Q. And we will talk about this further, but in the sampling that you have undertaken, you have testified that sample -- I'm putting up another slide here. Could you identify -- it has the heading Reach Designations. Could you just explain to the court what it is.

A. This is the same map that we looked at previously, but now having had added to it designations of sections of the waterway system which we refer to as reaches. These are arbitrarily defined sections of the waterway, defined in

collaboration with the Army Corps of Engineers. These were just simply for the purpose of reporting, to make it more manageable in the reporting and interpretation of information, to divide the waterway up into reaches.

Q. And over the course of the -- first of all, if you know, Dr. Lodge, from having worked on this project, in which direction, generally speaking, or directions, does the water in the Chicago Area Waterway System as depicted here, in which direction does it tend to show?

A. The water is flowing in general from Lake Michigan into the waterway.

Q. And water, for example, on the waterway where you see, let's say, Electric Barriers, do you see that?

A. Yes, the star --

Q. Right.

A. -- just to the right of the scale indicates the Electric Barriers.

Q. To your knowledge, would the general flow direction in that stretch of the waterway be away from the lake?

A. Yes, where there are rare occasions in the upper waterway where the flow might be temporarily reversed, it's my understanding that lower in the waterway the flow would be predictably from the lake direction southward, southward and westward.

Q. Now, I would like to back up to -- I had asked you

before what inference you draw from a positive sample for one of these tests. You indicated, I believe, that it's most plausibly, I'm paraphrasing this, but most plausibly explained in your view by the relatively recent presence of a live fish of that species in the vicinity, is that a fair statement?

A. Yes.

Q. Okay. And could you explain why you draw that inference?

A. We draw that inference largely on the basis not of any one positive result in isolation, but rather over time as information as accumulated, as our results have accumulated, to my mind a repeated pattern of positive results over time in similar areas of the waterway strengthens the inference that the DNA is likely resulting from living fish. There are, of course, some other possible explanations for the occurrence of DNA in the water, just as in a forensic setting there would be other possible mechanisms for DNA to have arrived at a crime scene other than the suspect having been there, I suppose, but the most plausible explanation, considering our results as a whole, are that the results as a whole indicate the presence of living fish.

Q. All right. The sampling results, as you testified earlier, were reported in series as the results were confirmed by your laboratory, correct. In other words, you would process a certain number of samples, go through your quality

control procedures, and then report the results, is that correct?

A. Yes, and we got faster as time went on and we formalized our quality control procedures as we went along, especially in response to the audit of our procedures in the laboratory by the EPA.

Q. Could you explain briefly what you just referred to, the audit of your laboratory procedures by the EPA?

A. So because of the management relevance of what we were doing and the results we were reporting and the widespread interest that they garnered and the criticism that they garnered, we asked and the Army Corps, agreed to sponsor, to cause, to motivate an audit of our laboratory and of our procedures by the quality assurance team at EPA, and that audit, the visit by that audit team, a team of experts, was conducted in December of -- I believe in December of 2009.

Q. I believe that process is described in some of your prior statements, I'm not going to go through it in great detail, but -- well, first of all, were the individuals who participated in that audit team, were they independent of you and your colleagues?

A. Yes.

Q. And did they, to your knowledge, review in detail the procedures that you and your colleagues were employing?

A. They reviewed in excruciating detail all the

laboratory procedures that we use.

Q. And did they also have occasion to learn about the sampling techniques and methods that you used?

A. Yes, we described for them how we did the sampling in great detail in the field, so they considered everything from the field sampling to everything we did in the laboratory including the provision during the visit of blind samples that we analyzed during the visit and then reported the results to them.

Q. And did you ultimately obtain a copy of the report that the audit team prepared?

A. Yes.

Q. Did the report make any recommendations for improvements or modifications in your procedures?

A. In general, the report was a very strong endorsement of our procedures. The report also included some recommendations for improvements, particularly in our reporting and quality control procedures, recommendations that as the team, the audit team acknowledged did not undermine the confidence in the results that we had reported previously, but nevertheless would be helpful to implement in future, which we have done.

Q. Now, as these results were reported, they were complied at different times, correct? I have displayed here eDNA Results for 2009. Do you recognize that figure?

A. Yes, this is a figure which summarizes our results for 2009. This depiction does not distinguish silver and bighead carp, but it some summarizes the results for Asian carp collectively for 2009 in a formal that early in this process, earlier in this cooperative agreement we agreed on in collaboration with representatives from the Army Corps of Engineers, in particular Colonel Quarles and General Peabody.

Q. Okay. If you could, perhaps using your pointer, in the upper left-hand corner there are some color-coded keys. Could you briefly to the judge what those keys indicate?

A. So what we are trying to indicate, first of all, is indicate both where we found positive detections, that is, found DNA from either silver or bighead carp, and it's also important, of course, to indicate where we have sampled, but where our results were negative, that is, we did not detect any DNA from either species. And the different colors in each row indicate the number of sampling trips in which we got either a negative or a positive result from one, two or three or more.

Q. I think this is implicit, but just to be clear, you, your colleagues, the people who collected the samples in the field visited various reaches of the waterway on different dates and on those dates on a certain trip collected a series of samples, correct?

A. Yes. When we began the formal surveillance program

in the Chicago area waterway, everyone agreed that the most reasonable way to go about it was to start in the southern reaches of the waterway, first of all, where everyone agreed the fish already were, to see what the DNA signal looked like from those reaches, and then gradually to move northward to try to define where the invasion front was. That was the goal of the surveillance program, was to define the invasion front, what is the northernmost or easternmost place in the waterway where we have evidence that either silver or bighead carp existed.

And because we could only manage a certain number of samples in a given time, we did that iteratively.

Q. Again, this figure here aggregates sampling results from a series of trips in calendar year 2009?

A. Yes, this summarizes everything we reported for 2009.

Q. Now, did you also -- first of all, in reporting your results, am I correct in understanding that you in your reports to the agency, the Corps in particular, you would specifically identify some sort of coordinate the exact location of each sample?

A. We provided in our reports, regular reports to the Corps a table with more detailed results than are represented here broken down, for example, by species.

Q. So looking at the yellow category, maybe it's the

way this slide printed, I would like to direct your attention to this area here, do you see where I'm indicating, where it says Calumet River?

A. Yes, the Calumet River north of the O'Brien Lock.

Q. Should that be read as yellow?

A. Yes. In 2009 what that is indicating is that there was one sampling occasion on which we found at least one positive water sample for either silver or bighead. In this case it was silver.

Q. Okay. Again, the coding indicates that on that date there was at least one date on which at least one positive sample was detected in that reach, correct?

A. Correct.

Q. Do you recognize what I have just put up on the screen here, sir?

A. Yes, these are photographs, aerial photographs of the same region of the map to which you were just referring.

Q. Okay. And the contrast may be a little bit poor, but if I'm correct, would you agree there is a reference to five separate sites, do you see that?

A. Yes, each of those red triangles indicates the location of one water sample in which we detected DNA from in this case silver carp.

Q. And just for orientation purposes, this area here -- are you familiar with where Calumet Harbor is?

A. That is the Calumet Harbor area.

Q. And so do you agree, sir, on this particular day, December 8th of 2009, there were a group of four samples in this range here and there was another positive sample down here, at site II, do you see that?

A. Yes.

Q. And there is a reference there to TJ O'Brien Lock. Could you indicate to the court approximately where the lock is located?

A. The O'Brien Lock is about right here. This rendition of this makes it difficult to see, but it's about right here.

Q. Have you and your team also -- strike that. I'm going to put up another graphic here. This one has the heading DNA Results for 2010. Do you recognize this?

A. Yes. Again, it's a map which we have provided previously to the Army Corps of Engineers and has been made publicly available.

Q. And again, does this aggregate data from multiple sampling trips in 2010?

A. Yes, this does for 2010 what the previous map did for 2009. In addition, this map also indicates in gray any reach that had at least one positive result for 2009, so in this case one can see where there is a yellow overlay, for example, on a gray area, that means that we got positive

results both in 2009 and in 2010.

Q. And again, in the upper left-hand corner the color code corresponds to the number of independent sampling dates?

A. Yes, same scheme as used on the previous map.

Q. Okay. Dr. Lodge, do you recognize what's depicted here? This is 27 May 2010 Samples Silver Carp Positives?

A. Yes, this is the same kind of depiction for a different area of the waterway, in this case the area of the waterway including the Chicago River, the junction of the Chicago River with Lake Michigan, and then a bit further downstream in the lower photograph, a little bit further downstream in the area of what I believe is called Bubbly Creek.

Q. And the picture, there are two pictures on this slide. The one at the top is --

A. The one at the top is showing clearly the junction of Chicago River with Lake Michigan, and the one at the bottom is again a bit downstream from that.

Q. And again, so this depicts the fact that on this sampling date in these stretches of the river the samples collected and analyzed by your team showed eight positive detections for silver carp, is that correct?

A. That's correct.

Q. But again, if you, just looking at this sort of simplified thing here, putting back up the DNA results for

2010, where are those eight results, where would they be?

A. So those eight results are spread across these two yellow blocks right here. The lower photograph in the previous slide includes the junction between these two reaches.

Q. Dr. Lodge, I had asked you earlier about inferences that you draw as a scientist from the positive results, and I believe you talked about looking -- I believe you used the word "pattern," perhaps you didn't.

In drawing inferences as a scientist from this set of data, have you attempted to summarize or explain how the distribution of data over time and at different locations supports inferences about whether or not live fish of the targeted species were actually present?

A. Yes, from the beginning of the project and especially, of course, as we began to get positive results higher and higher in the waterway or that is, closer and closer to Lake Michigan, we were very concerned that we fully, as fully as possible entertain any alternative explanations to what I regard as the most plausible explanation, the presence of live fish.

So we have had numerous meetings, discussions, conversations, about other potential ways in which DNA could be present without the presence of a living fish.

Q. And I would like to turn to those in a moment, but

before we do that, I'm going to ask you to identify this graphic I just put up on the screen here. It has the heading Data Interpretations, Strength of Evidence For Living Fish.

First of all, Dr. Lodge, who prepared this?

A. So my team and I prepared this as a way to communicate what, the way we regard the strength of evidence for the presence of living fish. This format has been used in a variety of presentations and has been made available previously. I have updated this to reflect all our current results from both 2009 and 2010.

Q. When you say "presentations," would that have included presentations to representatives of the Corps of Engineers?

A. I believe so.

Q. So there is a lot of information here.

A. Yes, the answer to that last question is definitely yes.

Q. Okay. On the left-hand side you have Strength of Evidence, Stronger and Weaker. Maybe that's intuitively obvious, but could you explain to the judge what you intend by that?

A. Well, I think again, as -- I mean, the appropriate mind set of a scientist is skepticism. So from the beginning we have engaged as fully as we possibly could those, both the ideas that we came up with in our own mind about what

alternative explanations might exist for the presence of DNA and also those explanations offered by many other parties.

So this depicts a way that we began to think about this to sort of formalize our way of thinking about this, and we are simply trying to indicate with that arrow on the left-hand side it's just a relative scale. I don't regard any of this evidence as weak, for example, but we are saying as more evidence accumulates, the confidence in the interpretation increases.

Q. Okay, let's start from the top. On the left-hand side it has the legend eDNA Detections Confirmed by Alternative Detection Methods. Would you explain what you mean by that.

A. So what we mean by that is that in three cases, those listed on the right, under Example Reaches, in this case that's a comprehensive list, not just examples, after very considerable effort using traditional tools, electroshocking or netting or rotenoning, areas where we had previously found positive eDNA results, from those same areas a fish was either captured or seen and identified by experts independent from us.

So for example, in Brandon Road pool in August of 2009, we, the first indication that anyone had ever made publicly available, first indication that I'm aware of that either silver or bighead carp existed in Brandon Road Pool, which is

the pool below where the electric barrier is, the first indication of the presence of Asian carp there was our positive DNA results reported early on because we, remember, we started our sampling, went from south to north.

After extensive electrofishing effort by the management agencies and after conversations while they were in the midst of doing this days long or I can't remember, perhaps a couple weeks of electrofishing effort, we said, "Well, this area over here is where we actually got the, took the water samples that were positive." They focused their effort there and indeed turned up a silver carp, which was not recovered, was not captured, but I think it was a Fish & Wildlife Service crew in the boat that saw it and they identified it.

The second two examples involve the capture of bighead carp. So again, the first indication in Lockport Pool that Asian carp existed was our positive DNA results. And on the basis of those, a very extensive effort culminating in rotenoning, an extensive rotenoning effort in December of 2009 turned up one bighead carp that was recovered before it died and sank in the canal in the Lockport pool.

The latest, the third example up there is the capture of a bighead carp in Lake Calumet in the vicinity of the waterway, which we looked at earlier, where we have repeatedly gotten positive results for bighead and silver carp. We had not previously gotten positive results in Lake Calumet itself,

but in the area both south of and north of O'Brien Lock we had detected one or the other fish.

So considering the movements of fishes, I regard all three of these as examples where when motivated by our DNA results, the management agencies launched extensive efforts to in their minds validate our DNA results with traditional methods and indeed, in these three cases they did so.

Q. Okay. Again, looking at the next couple of categories, the next one down, Positive Samples Over Different Years, what do you mean by that?

A. So what we mean by that is in the waterway sections that I list there are all areas in which we got at least one positive sample in a reach in 2009 and in 2010.

Q. Okay. Hopefully, the rest are self-explanatory, Repeated Trips With Positive Samples Within A Year and then Multiple Positive Samples from a Single Trip. Is one of the examples you list there the Chicago River?

A. Yes, in the Chicago River we got, as the earlier aerial photograph that we looked at in the Chicago River section, we got multiple samples in which we recovered silver carp DNA, but all were from a single trip.

Perhaps it's important to add too that for most -- well, we have not been to any of these sections very many times, I think four, maybe five in the O'Brien Lock area, but because our goal from the beginning was to define the invasion front

and we first wanted to get as broad a coverage of the entire waterway as possible, we moved as rapidly as we could from north to south, but, but recognizing the tension and compromising, if you will, in recognizing the importance of sampling again areas where we had positives in order to gain confidence and particularly under the suggestions of the management agencies to gain confidence in the fact that there were repeatable results present there and the management agencies also saw it as important that if they were going to consider management actions that it would be important that there be repeated samples there and that those positive results be as close in time to any contemplated management action as possible.

Q. In that regard you testified a few minutes ago about in the uppermost column, that is, observations of fish in areas that were at or near where you had had positive eDNA detections, Dr. Lodge, you're aware, are you not, that in I believe it was approximately May 20th of this year a netting and then a rotenoning effort was carried out in the Chicago Sanitary Ship -- excuse me, the Cal-Sag Channel?

A. Yes. So there are, depending on what criteria one uses, one could say that there are three other instances in which extensive deployment of traditional tools were motivated in the same way as the examples that I provide up here, but in those other three cases no Asian carp was recovered.

I refer there to an effort early on in the I&M Canal, but I would qualify that by saying that I believe our previous two sampling efforts in the I&M Canal had actually not uncovered any positive results, but we had found positive results at an earlier time.

Then there is an effort in the Wilmette region, the North Chicago River region in which an extensive netting, at least netting, I'm not sure whether electroshocking was part of that also.

Q. Do you want to indicate just where?

A. We are talking about this area up here, the North Shore Channel area, below the Wilmette pumping station in which we had gotten repeated silver positives.

In that case -- however, again, the placement, the deployment wasn't really exactly in the area where we had seen the positive hits.

And then the third example would be the extensive effort of netting and again I believe electroshocking in the Calumet River region down here this spring. But again, it was, the effort was in an area where we had previously gotten positives, but the two previous sampling trips had provided only negative results.

Q. Let me just be clear on that just temporally. So if I understand your testimony, you're saying that the area where this rotenone and netting operation occurred in May of this

year, these were a stretch of the river or reach of the river where you had in the past positive samples, correct?

A. Yes.

Q. But had you -- what were the results of the most recent eDNA sampling effort in that same area?

A. The two sampling occasions that were closest in time to the netting effort had produced no positive DNA results.

Q. Dr. Lodge, you touched on this earlier and I want to go back to it because it is I think quite significant in the context of some of the disputed issues in this case, and that is you have testified that in your view the most plausible inference that you draw from a positive detection for either species is the relatively recent presence of a live fish in the vicinity, but you have also said that you and your colleagues have considered other explanations, correct?

A. Yes.

Q. Okay. Let me just walk through some of those that have been publicly discussed. One of them has been the suggestion that it's possible that DNA or genetic material from one or both of these species could have been transported north of the -- or that is lakeward of the dispersal barrier system in ballast water on a barge or vessel. Are you familiar with that hypothesis?

A. Yes, we have considered this, pursued it as much as we could, short of actually taking samples from ballast, which

we have suggested but have not had the opportunity to do. We have had meetings, members of my team, not I personally, but members of the team have had meetings with barge operators, joint meetings with the Coast Guard, for example, to discuss their practices and how plausible such a mechanism might be to transport water that might have DNA in it from south of the waterway northward, and in light of those discussions and in light of a U.S. Coast Guard provision, which I believe may first have been voluntary, but then I think became mandatory, that barges not transport ballast water from south in the waterway to northward.

It seems very, very unlikely to us and to the navigation industry representatives to whom we have talked that that's a plausible explanation for DNA transport. Remembering also again the degradation rate of DNA would be another consideration in that.

Q. And with respect to I believe you testified earlier that among the places that you and your team have had positive detections for one of the Asian carp species are in a reach in the vicinity of Wilmette or in the North Shore Channel, is that correct?

A. Yes, that's correct. In fact, that area where we have had repeated samples, the area to which we are referring is up here, that area in which we have had repeated positive results for silver carp is an area in which there is never any

barge traffic. So at least in that area where there have been repeated positive results for silver carp, it can't possibly be the case that transport of bilge or ballast water is an explanation.

Q. I believe another alternative explanation for the presence of genetic material from these species is discharge from wastewater treatment plants or sewage treatment plants. Are you familiar with that suggestion?

A. Yes, and again, we have pursued this as much as we could. Without having the opportunity to take samples directly from the effluent of the sewage treatment plants, we have sampled in the waterway as close as possible to the outflow from those plants.

There are four major sewage treatment plants in the Chicago area, and we have sampled in the vicinity, as close as we could, I believe in some cases multiple times and have never gotten a positive in the samples taken closest to the effluent of the sewage treatment plant.

Q. Go ahead.

A. It is also likely unlikely that one would still have the DNA of a fish present after the extensive biological processing that occurs in a sewage treatment plant and in fact is part of the design of a sewage treatment plant is to degrade compounds.

So it's first of all, just on first principles highly

unlikely that DNA would survive transport, survive the duration and processing of a sewage treatment plant.

But again, the most direct answer I can provide for that is we have taken samples repeatedly as close as possible to those effluents and have never gotten a positive in the samples closest to the effluent.

Q. Another alternative hypothesis that has been discussed publicly for the presence of bighead or silver carp eDNA in the Chicago Area Waterway System is the theory that it's possible that a bird or birds had eaten the remains of a portion of one of these fish, digested it, and then excreted that and that some genetic material would thereby enter the water column.

Are you familiar with that hypothesis?

A. Yes. Again, I have had lots of conversations and thinking and brainstorming about this, but again, without the opportunity to directly test the plausibility of this, we have to rely on indirect evidence and the literature of previous studies of gut passage of DNA.

So I first of all say that it is possible, it has been documented multiple times, for some DNA to survive gut passage in, that is, DNA of something that was consumed, an organism that was consumed can survive gut passage, but it's not much of the DNA and it's -- so first of all, you could not possibly be talking about large quantities of DNA, and considering the

dilution factors that we would be thinking about in any parts of the waterway, the large volumes of water we are dealing with, that would be one just on first principles Way of thinking about it and I would conclude it's unlikely that that could happen.

Secondly, I would say we would have to be thinking about where in fact the gulls would find carp to eat and how likely that is to happen and produce the pattern, the pattern repeated in space and time that we see in the canal.

Our field team has, of course, with this possible alternative explanation in mind has tried to observe the occurrence of gulls, which would be the most likely suspect in the waterway, and see no evidence of any repeated pattern of the occurrence or abundance of gulls that would in any way be consistent with the patterns that we see.

Having said that, I would certainly say that this could benefit from some more observations and experiments, but on first principles and on the observations that are available in the field, and on the basis of the lack of evidence for this that anyone who has promoted this idea has provided, I conclude with some confidence that it's highly implausible as an explanation for the overall pattern of positive results that we see.

Q. Another hypothesis that has been mentioned publicly is that the genetic material is present in the waterway above

the barrier as a result of the release of bait fish, that is fish, juvenile fish of one or both of these species that would have been collected or used by a fisher and then dumped or released into the water. Are you familiar with that hypothesis?

A. Yes, although I would put that in a different category of explanations. That's an explanation potentially, an alternative explanation for how living fish might have gotten north of the electric barrier. But in that case we would be talking about, there are living fish being present, it's just a question of how they got there. So that's not so much an explanation for how DNA might be present without a living fish being present.

Q. And similarly, it has been suggested that it's possible that fish or one of both of these species were the product of what's referred to as a cultural release, that is, intentional release by a human of a fish for some cultural or other purpose.

A. Yes, again, it's well documented in scholarly papers, book chapters, and well-known for people who have spent time in Asia, especially, that in some Asian cultures in particular, that there is a practice of releasing out of a respect for living organisms, a practice of occasionally releasing. This is sometimes referred to as prayer release sometimes as ritual release.

It's also, of course, true that people for many reasons occasionally release fish out of any number of motivations. I could speak for myself as a kid having moved a number of organisms around, and I suspect others in the courtroom could also. So this wouldn't be limited to prayer release or cultural release, but it is true -- the main point here is that yes, of course, people could introduce fish north of the barrier.

Again, that's a possible explanation for how living fish could be present. It's not getting at the reliability of eDNA as the presence of living fish, it's just an explanation for how living fish could be up there.

So I think that's possible explanation. Again, I can't really evaluate it except with respect to this. It is an unlikely explanation for the occurrence of silver carp. It is a potentially better explanation, though none of us can say with great confidence how good an explanation, it's not a good explanation for silver carp, possibly for bighead, but not silver, because silver carp, and I take from Dwayne Chapman and others who know the aquaculture industry and other fish markets better than I, that silvers are not raised in the way, in the numbers and frequency that bighead carp are, and they are, they are rarely, if ever, available for anyone who might be so inclined to release a fish for whatever reason.

So it's a possible explanation for big heads, but not for

silver, but again, it's a possible explanation for how living fish could be above the barrier.

BY MR. REICHEL:

Q. But it wouldn't negate -- they would be living fish?

A. Living fish.

THE COURT: Mr. Reichel, if you get to a logical stopping point, we are probably at a good time to take a break, any time in the next couple of minutes.

MR. REICHEL: Let me just do one more on this line.

THE COURT: Sure.

MR. REICHEL: Actually, your Honor, I think where I'm at right now is a logical stopping point. I am approaching the -- I do have unfortunately some additional questions, not unfortunately, but in all candor I --

THE COURT: That was my next question for you is how much more on direct do you anticipate ballpark?

MR. REICHEL: 20 minutes to a half hour.

THE COURT: Okay, very good. Let's start up again at 1:30, and we won't put Dr. Lodge under oath again, we will just remind you that you remain under oath and you will be so when you come back, okay?

THE WITNESS: Thank you, your Honor.

THE COURT: Very good. Okay, thanks a lot everybody. See you at 1:30. Thank you.

(Recess to 1:30 p.m.)

IN THE UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF ILLINOIS
EASTERN DIVISION

STATE OF MICHIGAN, et al.,)
) Docket No. 10 C 4457
Plaintiffs,)
) Chicago, Illinois
v) September 7, 2010
) 1:30 p.m.
UNITED STATES Army Corps of)
Engineers, et al.,)
)
Defendants)

TRANSCRIPT OF PROCEEDINGS - PRELIMINARY INJUNCTION HEARING
VOLUME 1B
BEFORE THE HONORABLE ROBERT M. DOW, JR.

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THE COURT: Good afternoon, everybody. Dr. Lodge, if you want to come back and resume the witness stand, that would be great. Thank you.

Okay, Mr. Reichel. I'm sorry, I'm organizing all my paper here.

MR. REICHEL: Whenever you're ready to proceed, your Honor.

THE COURT: Okay, very good. We are ready to proceed then, Mr. Reichel.

MR. REICHEL: Thank you, your Honor.

THE COURT: Thank you.

BY MR. REICHEL:

Q. Dr. Lodge, I have asked you a series of questions earlier today about inferences that you draw from positive eDNA results. Now, you have also testified that you and your team took several hundred samples over the last few years and that obviously a number of those were negative.

So let me ask you now in a general way as a scientist and the person, the team that's developed the application of this method, what inferences do you draw from a negative result from an eDNA sample using the method that you have used here?

A. Well, I think regardless of the surveillance method that's employed, traditional tools or eDNA, a negative is always going to be a more ambiguous result than a positive, that is, a negative is always subject to detection limits and the evidence

in comparing the different traditional and eDNA tools as we have discussed earlier today suggest that eDNA is a more sensitive tool, that is, it has a more sensitive detection limit. However, a negative still does not, we can't have confidence necessarily that a negative means absence, it simply means there is not enough DNA for us to detect.

Q. In the particular sample that you have collected?

A. In the particular sample.

Q. And now, you have testified that again, a number of samples were taken at various locations or reaches within the Chicago Area Waterway System, but despite that fact, would it be accurate to say that that there was a substantial portion of the water body contained within the Chicago Area Waterway System that has not been sampled by your team at any point?

A. Yes. At the broadest scale, the areas in the east, most eastern part of the waterway in Indiana have been sampled the least. I indicated earlier that we are in the process of analyzing some samples from that region, but I would also say more generally that it's a very large waterway and although we have taken on the order of 1,500 samples to date, that is still quite in some sense a spotty coverage for such a large waterway.

Q. Just to back up, just so the judge understands, your comment a moment ago about the eastern most areas, could you indicate generally the region you're referring to?

A. So we are talking about the areas over here.

Q. So the record could reflect, you were circling an area that's depicted, Grand Calumet River and Little Calumet River toward the right-hand side, is that --

A. Correct.

THE COURT: And just so I can be clear, there is a line that goes down from, does it say Calumet River right in the lake there? That line is the Indiana border, is that right? Yes, that one right there, is that the Indiana border? Right there. That kind of looks like -- that looks like Will County there, and Will County goes to the border. That's the Indiana border?

MR. REICHEL: That's my understanding, your Honor.

THE WITNESS: I believe that's correct also.

THE COURT: Okay, I just want to make sure I have got my geography down here. Thank you.

BY MR. REICHEL:

Q. Before we took a break, you had also testified about your interpretation of the data collected at different times and locations within the waterway system and inferences you drew about that, the strength of inferences that you drew with respect to the likely presence of live fish.

Let me just put a couple of other things up here and ask you to identify them. Do you recognize this, Dr. Lodge?

A. Yes, this is a table that my team and I prepared to indicate for each of the reaches in the upper CAWS region what the level of evidence we have gathered from DNA analysis about the presence

of eDNA indicating the presence of fish.
Q. So, for example, the left-hand column has these abbreviations that correspond, correct, to the reach designations we talked about earlier?
A. Yes.
Q. The next column is Sampling Dates?
A. Yes.
Q. And then the next one is the sampling result, either no detection, positive detection, et cetera?
A. Yes, that column is results by date by sampling episode.
Q. And the right-hand column, Evidence of Presence, do these descriptions relate to the right-hand column in that other diagram you put up?
A. Yes, so these descriptions relate directly to the diagram that we looked at earlier about what we regard as the strength of evidence for the presence of fish.
Q. This looks a little bit similar, but do you recognize what this is, Dr. Lodge?
A. Yes, this is an abbreviated version of the same table we just looked at. What is missing from this table with respect to the previous table is all the reaches in which we never got a positive detection in, in either year in which we have taken samples, 2009, 2010.
Q. So the second table is essentially a subset of the preceding one?

A. This is a subset of the previous one focusing exclusively on those reaches in which we have found at least one positive result for at least one species at least one time.
Q. And again, Dr. Lodge, so the record is clear, what you have tabulated here or what are tabulated in these last two figures are date that you did, you or your team reported to the Corps of Engineers over time, is that correct?
A. Yes, that's correct. These tables are updated versions of tables that have previously been provided to the Corps.
Q. Okay. But for example, earlier I had shown you what was provisionally admitted as Plaintiffs' Exhibit 1. These tables were not in that in that document, were they?
A. Remind me what Exhibit 1 was.
MR. REICHEL: I'm sorry. May I approach, your Honor?
THE COURT: Sure.
THE WITNESS: No, the tables that we just looked at, I believe they do not occur in here. They were rather part of our series of regular reports to the Army Corps of Engineers.
BY MR. REICHEL:
Q. Right, so the document I just handed you, Dr. Lodge, has a reference to the fact that you submitted these regular reports, but it does not contain the data itself.
A. Correct.
MR. REICHEL: Your Honor, just in the interest of completion or clarity of information we presented here, although

I initially described these as demonstrative, I think to assist the court in reviewing the evidence what I propose to do is to collectively mark this series of 12 slides or overheads that I projected here to the witness as Plaintiff's Proposed Exhibit 2 to be offered into evidence.

THE COURT: Okay, any objection to that counsel?

MS. RUDOLPH: One minute, your Honor.

THE COURT: Oh, sure, absolutely.

(Pause)

MR. REICHEL: I guess I should say Plaintiff's Proposed Group Exhibit 2.

THE COURT: Right.

MR. RIESER: I'll interpose the same objection. Some of this material is, within this group exhibit is, has been seen before and has been part of a number of older reports. Some of this material is new and may be objectionable based on further discussion with Dr. Lodge.

THE COURT: Okay.

MS. RUDOLPH: I'm sorry, your Honor, one moment, please.

THE COURT: Sure, that's fine. I don't know what you guys have seen before and what you haven't, which is why I'm inquiring at this point.

MS. RUDOLPH: Your Honor, I think we would also like the opportunity to check in with our experts and see if this also reflects what has previously been submitted to the Corps of

engineers, but that's something we can get back to the court later on.

THE COURT: That's fair enough. I mean, when we are not in preliminary injunction mode, of course, I would have everybody clear their demonstratives with each other and you would have an opportunity to see exhibits and object to them. I think because we are a bit more on the fly here, given the press of time, what I'll do is the same thing I did with the previous one, which is to provisionally admit it subject to objection later if you all after you have had a chance to review the documents find something objectionable. Obviously, because it's a bench trial scenario, if there is a reason to strike the exhibit later, I can do it, okay?

MR. RIESER: Thank you, your Honor.

THE COURT: It will be helpful to me to have these collected in one place in the event that some or all of them are admissible and useful. I thank you for that, Mr. Reichel.

MR. REICHEL: Thank you, your Honor.

BY MR. REICHEL:

Q. Dr. Lodge, I would like to now turn to a subject broader than just the eDNA data that we have been discussing here.

Having been involved in the subject of this potential or the movement of these two species through Illinois waterways and their detection, as you have testified earlier, in the Chicago Area Waterway Systems, I would like to ask you to consider three

things. First, the available information that you have testified to earlier about the presence of populations of bighead and silver carp in the Illinois waterways that are connected to the Chicago Waterway System, number one; number two, the eDNA data that you and your team have collected and analyzed; and third, and you have touched on this earlier, the actual observation or detection on three occasions that you talked about earlier of individual numbers of bighead or silver, depending on the circumstances, at the three locations you described earlier.

Looking at those data collectively, and based upon your training and experience as a biologist who focuses on invasive species, have you reached any conclusion as to whether or not the conditions that exist today present a risk that additional bighead or silver carp may migrate from the Chicago Area Waterway System into Lake Michigan or other waters connected to it?

MR. RIESER: I'm sorry, your Honor, I object. It contains a statement about additional fish migrating and there isn't evidence of any fish migrating, simply the identification of eDNA data.

MR. REICHEL: Can I rephrase?

THE COURT: You can rephrase the question because I guess it's just the "into Lake Michigan" is where there is no evidence at this point, right? Is that the nature of your objection?

MR. RIESER: And the migration itself.

THE COURT: Well, I'll sustain the objection as to the "into Lake Michigan." You can rephrase the question I'm sure, though.

MR. REICHEL: Thank you, your Honor.

THE COURT: Sure.

BY MR. REICHEL:

Q. Well, Dr. Lodge, let me turn to the focus of that objection. Based upon the eDNA data that you have looked at, have you -- what inference, if any, do you as a scientist draw about whether or not one or possibly more silver carp have entered Lake Michigan from the Chicago Area Waterway System?

A. We have rarely sampled in the lake itself. Really, never has the lake proper been a focus of sampling. However, one of the positive results which was displayed earlier, that in Calumet Harbor, was in a location that is in a slip in Calumet Harbor and open to Lake Michigan, so depending on one's definition of the boundary of Lake Michigan, one could argue that that positive result is in fact in Lake Michigan.

In addition, I would say are multiple positive hits of silver carp in the area above O'Brien Lock in that same general stretch of waterway and the capture of the bighead carp in Lake Calumet demonstrate in the case of bighead carp, and I would be tempted to say the same thing for silver carp, certainly positive DNA results I would infer indicate the presence of living silver carp in both cases, then we have species with access, unimpeded

access to Lake Michigan, that is, there is no physical barrier between the location of the fish and Lake Michigan.

Q. Going back to the question I posed earlier, let me try to restate it in slightly different terms.

Based upon the available data that you have that we talked about, have you formed an opinion as to whether or not there is a risk under present conditions that individual bighead and/or silver carp may migrate from the Chicago Area Waterway System into Lake Michigan and connected waters?

A. Yes, I think there is a risk, a very urgent and imminent risk of invasion given the demonstrated presence of bighead carp with unimpeded access to Lake Michigan and the indication from eDNA that the same situation applies to silver carp.

Q. And Dr. Lodge, as was noted earlier, you have previously testified in a different forum, not in a court case, but before a congressional committee that was dealing with the subject of Asian carp, if you recall, in February of this year.

Do you recall that testimony, sir?

A. Yes.

Q. I'm not going to ask you to repeat it, but one of the topics that you addressed at that time, sir, was I think under the heading of Science Based Management Actions related to this issue. Do you recall testifying on that subject?

A. I do.

Q. Okay. First of all, again, I think you touched on this

earlier in describing your professional work, but I believe as a scientist, has part of your work in recent years related to efforts to make available scientific information to decision makers as to guide or provide information to decision makers about options that may address issues involving invasive species?

A. Yes, I think I referred earlier to one of the primary motivations of the creation of the Center For Aquatic Conservation and more broadly many research projects that I have led or been involved in in recent years has been to tailor our research questions in a way that is most relevant to natural resource management and policy needs and to communicate those results and to partner and collaborate and cooperate with all the relevant stake holders to maximize the probability of our information being used appropriately to make management and policy decisions.

Q. And from your perspective as a scientist and a specialist in invasive species, given the risk that you testified to a moment ago, what -- I believe you used the word "urgent."

What would you describe as the goal or goals of actions that you believe would be urgently needed in this situation with respect to the issue of potential invasion of the waters by these species?

A. Well, let me say first of all, there is a large body of literature in which I have participated, authored or co-authored by biologists and economists which recognize as a general

principle that preventing spread or preventing invasion in the first place is a far more cost effective strategy for society than waiting for invasions to happen.

One of the reasons this is true in general is that invasions are unfortunately in our rich experience in the United States and elsewhere, including the Great Lakes, invasions are too often irreversible, that is, we simply don't have the technology or even when we have the technology and know-how, we often don't have the resources necessary to control or eradicate an invasion.

So with that general well-established principle from the literature in ecology and economics, there has been, I believe, a shared goal by all the management agencies involved to prevent the invasion of the Great Lakes by silver and bighead carps.

Given that principle and that goal, then the theory of population biology, and a theory which is well validated empirically, suggests that the mechanism to prevent an invasion is to minimize the number of individuals and the number of times that individuals have the opportunity to escape or release into the environment that we are worried about.

So in practical terms, what that means is that if the goal is to prevent invasion in the Great Lakes, then any step that would minimize the number of individuals of silver or bighead carp gaining access to Lake Michigan should be considered.

Q. So let me ask you a series of specific questions. To the extent that there today exists physical structures between elements of the Chicago area waterway system and Lake Michigan, let me give you a specific example, sluice gates in water control structures such as the Chicago Lock and Dam and the Wilmette pumping station and the O'Brien Lock and Dam, that under certain conditions are open to allow water to pass in or out, would a measure such as installing physical barriers such as grates or screens over such openings, would that be a measure that could reduce the risk of additional individuals of either species that may be present south of those locations from, reduce the risk that they would enter Lake Michigan?

MR. HILL: Judge, I would like to object to that question. I'm not sure this witness is qualified to talk about the grates and screens on the sluice gates. He is not an engineer, he is a biologist.

THE COURT: Why don't we start by asking what he knows about sluice grates and screens.

MR. REICHEL: Fair enough.

BY MR. REICHEL:

Q. Dr. Lodge, you are not an engineer, are you, sir?

A. Correct.

Q. Are you generally familiar with what I mean when I talk about about a sluice gate?

A. Yes.

Q. Are you generally familiar with the concept of a metal screen or grate with openings in it that while they would allow water to pass would impede the passage of at least fish of a certain size; are you familiar with that kind of structure?
A. Yes. While I am not familiar with the details of those in the Chicago Area Waterway, I have certainly seen such structures in power plants and so forth and am familiar with the concept and the structures in general.
Q. Given at least the general level of that familiarity, is it your understanding that that kind of device would be an example of a measure that could reduce the risk of additional individual bighead or silver carp from transiting through such a sluice gate?
A. Yes, of course.
Q. Similarly, you're aware obviously that at two locations, Chicago Lock and Dam and the O'Brien Lock and Dam, that there are currently a series of locks that are controlled and operated by the Corps of Engineers, you're aware of that general fact?
A. Yes.
Q. And again, recognizing you're not an engineer, do you understand that those locks have gates that open and shut?
A. I'm sorry, back up a minute. The Army Corps of Engineers controls some of those structures and the Water Reclamation District controls, my understanding, is the Wilmette. I wasn't sure which of those you specified.

Q. Okay, let me be clear. The question I'm asking now is limited, it does not refer to Wilmette. It's referring to the actual locks, that is, the structures through which vessels, for example, may pass?
A. Okay.
Q. Are you aware, Dr. Lodge, that each of those sets of locks has gates in them that open and shut?
A. Yes.
Q. Again, applying the principle you described earlier, assuming that if the gates were in a shut position, do you believe that that would, or maintained in a shut position, I should say, do you believe that that would be an example of a measure that could reduce the risk that additional bighead and silver carp could migrate to the other side of the lock?
MR. RIESER: Your Honor, I really have to object. This is going way beyond what Dr. Lodge is expert in, doesn't, I think, he will readily admit he doesn't know about the gates, whether they open and shut, whether they even if shut would preclude the movement of Asian carp that has been cited by a number of different people, and it's way outside the area of his expertise.
And I'm sorry for objecting because I understand the latitude that you are providing, but I submit that this is beyond where the direction of his testimony or is what his expertise is.
THE COURT: As I understand it, his expertise has to do

with the fish themselves. He may not be an expert on the locks, but he understands how big the fish are, and I suppose he could make -- I'm going to overrule the objection. Obviously, you can cross-examine him on this.

MR. RIESER: Sure.

THE COURT: I certainly would acknowledge it goes to weight for sure, and when I weigh this testimony, I'll weigh it in light of his expertise, but I'm not convinced that he doesn't know anything here that could be helpful to the trier of fact.

You can go ahead and answer the question.

MR. REICHEL: Do you remember the question, Dr. Lodge?

THE WITNESS: Yes.

BY THE WITNESS:

A. Let me just say that fish cannot swim through physical barriers. Whatever the nature of a barrier, if the openings are smaller than the fish, then it seems highly unlikely, indeed impossible, for a fish to swim through it.

Q. And on the subject of physical barriers, are you familiar with what's called a block net? Do you know what that is?

A. Yes.

Q. And what do you understand that to be?

A. Well, I mean in general, again, I may not be familiar with the particulars of deploying it in the way that it has been or considered, but it's a net simply designed to prevent the movement of fish. For example, in a rotenoning episode, if you

want to limit the movement of fish in preparation for applying a poison, this has been used in some of the episodes, in addition, such a thing could be used to prevent access to whatever area of the waterway that you wanted in principle.

Q. And again, this would fall within -- would this fall within the general category of a physical barrier that you talked about earlier?

A. Yes.

Q. I think you have alluded to this earlier and perhaps this is self-evident, but I'll ask anyway. You're aware that, and you have testified that under at least a couple of occasions in the last, less than a year, in certain segments of the Chicago Area Waterway System, the fish poison rotenone was applied in a couple stretches of the waterway, are you aware of that?

A. Yes.

Q. Okay. And again, as a scientist, do you have knowledge as to whether or not the application of rotenone can in the area where it's applied, at least during the time that it's applied, can that have the effect of killing bighead and silver carp?

A. Yes. Rotenone is a standard toxin that's been used for generations of fisheries biologists to kill fish.

Q. Dr. Lodge, you have also, going back to your congressional testimony of earlier this year, you also testified at least briefly on the subject of the potential impact from an ecological perspective of the invasion or establishment of a reproducing

population of bighead or silver carp in the Great Lakes or connected waters, did you not?
A. Yes.
Q. Now, you're aware, are you not, sir, that there have been -- there has been some -- strike that.
Based upon your review of the available information, to you as a scientist, do you have the -- what is your understanding, if any, as to whether or not there exists within the Great Lakes, let me just start specifically with Lake Michigan, there exists within Lake Michigan any portions of the lake or waterways connected to it that have the potential to support the continued presence of bighead or silver carp?
A. Certainly, the best documented waterway that is connected to Lake Michigan that supports abundant silver and bighead carp is the Illinois River connected to the Chicago Area Waterway System.
Q. And I guess let me ask you this, a different question. If bighead or silver carp enter Lake Michigan, just assume hypothetically, I'll just state this as a hypothetical question, from the Chicago Area Waterway System, to your knowledge as a scientist are there any portions of the Lake Michigan or other waterways connected to it other than the Illinois River that would have the potential to support the continued presence of bighead or silver carp?
A. The best review of evidence and scientific knowledge about the fish, which is encompassed in a book edited by Cindy Kolar

and Dwayne Chapman and others in 2007, identifies 22 rivers on the U.S. side of the Great Lakes, these are all the Great Lakes, that at least meet a rule of thumb, for lack of better information about having an unimpeded link sufficient to support reproduction of bighead and silver carp, the river closest to southern Lake Michigan, closest to the connection between the Chicago Area Waterway and Lake Michigan that meets at least that criterion is the St. Joseph River, which has its mouth in Michigan, but it runs also through northern Indiana.

Q. Dr. Lodge, going back to the issue of the risk that you described earlier of the potential for individual bighead and silver carp to enter Lake Michigan or other connected waterways from the CAWS, from a temporal standpoint, in other words, if the, that risk continues over time, how does that to you as a scientist affect your estimate of the risk that what you have termed an invasion may occur?

A. The more individuals that enter the lake, the more likely it is that a population will become established. What biologists mean, what I mean when we say "established" is that Joe and Jane Carp can find each other at the right time in the right place and successfully reproduce and that those young will be produced in sufficient numbers that they will survive long enough and numerous enough to again reproduce. So by "establish" we mean a self-sustaining reproducing population.

What we would dearly like to know as biologists is

exactly what the relationship is in mathematical terms between the number of individuals that were to gain access to an ecosystem of concern, in this case Lake Michigan, and the probability of this establishment happening.

We know that for very, very few species and circumstances, and we certainly do not do not know it for either silver or bighead carp in the Lake Michigan environment, what we therefore have to fall back on is just what we know from theory, that there is a positive relationship between the number of individuals and the probability of a population establishing. It is unlikely to be a linear relationship, but it is positive.

So the only -- the most relevant management advice that then emerges from that well established theory and empirical evidence is that it is important to reduce the number of individuals gaining access to the ecosystem of concern.

Q. Dr. Lodge, you testified earlier that as part of the work that you first did in connection with the Chicago Area Waterway System for the Corps of Engineers, one of the things you were asked to look at was the, was not limited specifically to bighead and silver carp, but rather focused on the issue of the potential for transfer of invasive species generally in either direction through the Chicago Area Waterway System, do you recall that?

A. Yes.

Q. And I believe this, you touched on this in your congressional testimony, but from a biological perspective as someone who has

devoted a substantial portion of his professional career to issues of the impact of invasive species, particularly aquatic invasive species, what conclusion or general management advice would you offer with respect to the issue of whether or not there is a need to create a separation between the Great Lakes Basin and the Mississippi River Basin?

A. When one considers the number of species that have already used the canal system, the Chicago Area Waterway System, to disperse, the numbers of species that are, if you will, poised or geographically located so that they could use the canal system to move either northward or southward into ecosystems where they do not occur, then it seems more and more important, the more species you consider, to explore the option of closing the waterway to the movements of species.

There has been a strong consensus among experts and stake holders for a number of years that in the long run, both ecosystems or both watershed regions, the Mississippi watershed and the Great Lakes watershed, would be best served by preventing species from moving through the canal. Examples that are instructive include zebra mussels and quagga mussels, which in fact use the canal to go southward. They were first introduced into the Great Lakes by ships and use the canal to very rapidly escape Lake Michigan and colonize the Mississippi River Basin or parts thereof and thence to colonize by other mechanisms Arizona, regions of the Colorado River, California waterways.

So this waterway has been and is a conduit for the movement of many species in the past, potentially of many more species in the future, and therefore any considerations about the management of the species with respect to damages to the environment or the economy or human health from species, would be most appropriate if it considered all those species, not just, for example, silver or bighead carp.

Q. In that regard with the concern, this broader concern about the transfer of invasive species between the Great Lakes and Mississippi Basin, are you aware, Dr. Lodge, that the Corps of Engineers has announced its intense to conduct what I believe is referred to as the Great Lakes/Mississippi Basin Interbasin Study. Are you familiar with that term or something like that?

A. Yes, I have heard this referred to many meetings with the Corps and other management agencies. I'm aware this is an important goal, mandate for the Corps.

Q. Again, I don't know how conversant you are with the details, but do you understand that the purpose of this study would be to look at the feasibility and options for long-term management actions to prevent the transfer of species in either direction through the waterway system?

A. Yes, of course, I mean, and that is one of the -- that's the context in which we first became engaged with the Corps in a cooperative agreement to take this broader, multi species risk assessment approach of what implications the canal has and its

management has for the exchange of species that may cause harm to human society.

Q. Again, from a biologically informed perspective that you bring to this issue, assuming that one is undertaking an evaluation of options for such an inter basin separation, from a time perspective do you believe that looking at it from a biological perspective that it is important that that be conducted sooner rather than later?

A. As I have said, there are a number of species that have already moved through the Canal system and caused great harm to the environment and human economy, dispersed through the Canal. So there are many species in the Great Lakes that are potentially harmful and do not yet occur in the Mississippi Basin. There are many species, on the other hand, that occur in the Mississippi Basin that do not yet occur in the Great Lakes. And all those species I'm referring to are non native to North America.

So there are many species that could, in fact, be moving through the canal as we sit here undetected. So in that sense, it is urgent that a longer term and improved solution be found for the management of the waterway.

Q. So, for example, if, just asking to you assume that it was projected that a period of up to five years from the present would be taken to just complete an evaluation of options for means to prevent, permanently prevent inter basin transfer, from a biological perspective do you believe that between now and

five years from now, is there a risk that additional invasive species may transit in either direction?

A. Yes, of course. I can give you one example. If we go back to zebra mussels that were first discovered in the Great Lakes in 1986, by 1992 or '93 they had already colonized the Mississippi down to New Orleans or near in the southern part of Mississippi Basin.

So once a population becomes established, it can increase rapidly. It depends on the species and the environment. But certainly a lot of population growth and dispersal can happen in five or six years.

MR. REICHEL: Thank you, Dr. Lodge, that's all I have at this time.

Nothing further at this time, your Honor.

THE COURT: Okay, very good, thanks, Mr. Reichel.

Ms. Rudolph, are you the opening cross examiner here?

Just for planning purposes, I don't know how long you think you have, this is for everybody out there, somewhere just this side of 3:00 we will take the afternoon break, and then we will pick up again 10 or 15 minutes after that and go to 4:30 or quarter to five, somewhere in there at least, okay?

MS. RUDOLPH: Very well. Thank you.

CROSS-EXAMINATION

BY MS. RUDOLPH:

Q. Before we get started, I just wanted to ask one quick question about the exhibit that you had gone through with plaintiff's counsel.

One specific question that I sort of was hoping that you can could help me with, on this paper right here, there is an area that's identified as the LACCM, do you see that about four up from the bottom there?

A. Yes.

Q. Okay. I was having a hard time identifying that area on the reach designation map right here, and I was hoping you could tell us what that area corresponds to.

A. So clearly, it's not on that map. So can we go back to the table for a moment?

Q. Sure. I can hand it to you too if that would help. It's kind of hard to see.

A. It may come to that, but hold on a minute.

Q. Does that help a little bit more?

A. Yes. Okay, so let's go -- okay, the table is organized so that it goes from south to north. Let's see, can you move the table down a little bit?

Q. Sure.

A. If you start at the top, we are moving from south to north and we first go up in the direction of the Chicago River and then up toward the North Shore Channel. Then there is sort of a geographic break under the NSC, North Shore Channel, and I'm

thinking out loud here because clearly we have got to try to see if we can understand what this LCALN is. And then we go back down south and we start with the Calumet branch where the Cal-Sag meets the Chicago Sanitary & Ship Canal.

So now let's look at the map, and so we're going -- so now we are on the part of the table that starts here CALL and we are going this way. So here we are right here. It's there, correct?

Q. No, that says LCALN, which is this one.

A. And we are looking for?

Q. LACCM.

A. Okay. So what I can tell you is it's somewhere over in that region and clearly, we have neglected to put it on that map.

Q. Okay, that's fine, I was just trying to identify the area.

A. I understand.

Q. Thank you.

A. You could check, of course -- those reach designations, as I said earlier, were developed in agreement with the Army Corps personnel, so there is a joint record of agreement on those reach designations. We may have made an error in either the acronym or clearly made an error by not putting it on the map.

Q. Thank you. The potential for the establishment of Asian carp in Lake Michigan and in the Great Lakes is a major concern for the federal government, right?

A. I believe that's the case on the basis of many statements

from management agency personnel and from the framework of the release by the White House.

Q. Now, ecosystem management in the context of invasive species looks at forecasting the introduction and establishment of an invasive species, sort of generally?

A. That is one component that people would see as part of ecosystem management in the context of invasive species.

Q. And then sort of generally in forecasting the potential for establishment and introduction, my understanding is there are certain things that one looks at. For example, one would look at the potential pathways for introduction?

A. Yes.

Q. The interactions between invasive and native species?

A. Well, we would have to pause here a minute and think about whether we are talking about the probability of introduction, the movement of individuals, or the probability of establishment of individuals should they be released in a region of concern.

Q. Okay. You would look at the characteristics of the species in terms of forecasting the potential for establishment?

A. Yes, one certainly -- there is a lot of literature, including our own, on silver carp, looking at the relationship or potential relationship between characteristics or traits of species and multiple stages in invasion, the probability of being transported or being introduced, as we said a minute ago. You could ask the same question about the way in which traits are related to the

probability of population establishment, given an introduction and so forth.
Q. And those type of characteristics that one would look at would be reproduction potential in the area would be one that you would look at?
A. Yes, of course.
Q. Sort of eating and food, is there a food source there or alternative food source available?
A. Yes, yes.
Q. And one would also possibly look at how temperature might affect that species if that was something that mattered to that species?
A. Yes, there is a whole host of characteristics of both the species and of the ecosystem that biologists have looked at and, of course, you would look -- your attention would be focused on different aspects, depending on what kind of species and what kind of environment you're talking about, birds, fish, mammals, whatever.
Q. And in sort of looking at sort of those questions that come up when you're forecasting the potential for establishment, in the scientific community you would look to models?
A. Models are an important way often to integrate a variety of information to understand what might happen.
Q. You could conduct field studies?
A. Yes, I mean the -- in an ideal world, scientists would always

want first and foremost to do empirical work, to conduct observations and certainly experiments. Failing the ability to do that, in particular models become an important tool, especially an exploratory tool to begin to understand what the possibilities are.

Q. One might also look at studies conducted in the laboratory?

A. Of course.

Q. You would look at sort of the existing literature?

A. Yes.

Q. And look at sort of and possibly also conduct risk assessments based on some of these other things?

A. Much of what you have already asked me about I would put in the category of components of risk assessment.

Q. And then so the idea is that you put all the information together and you come up with a recommendation based on the known knowledge and evidence at the time?

A. Well, as a scientist, and I think that's the context in which we are talking about, it's usually not the goal to come up with one recommendation, certainly not -- recommendations emerge from management agencies in a broader set of considerations by those responsible for making decisions.

As a scientist, my colleagues and I at many institutions in many settings see it as our role to provide guidance relevant to making decisions. So the advice that I offer is in the context of goals that have been established by broader means in

this case, as you asked to begin with, it is the goal of the management agencies from state and federal levels to prevent invasion of the Great Lakes by silver and bighead carp. It has been our goal to provide scientific information and analysis that could inform decisions about how to meet that goal.

Q. Smart people and scientists and people looking at ecosystem management can disagree about those management decisions in a given context?

A. Well, again, it's not the role of scientists to make those recommendations, so, of course, there can be disagreement as citizens about that, and, of course, there can be disagreement about the nature of scientific evidence and inferences that can be drawn just about the scientific inferences and what guidance might be relevant to a given goal or alternative set of goals.

Q. And now, there are certain uncertainties that are sort of inherent, aren't there, kind of in the area of invasive species management?

A. As in all of life.

Q. Now, the report that was discussed earlier around I'm referring to what's titled The Aquatic Invasive Species Risk Assessment for the Chicago Sanitary & Ship Canal, I think you said it was a July 2010 publication?

A. Yes.

Q. Which was accepted as an exhibit earlier today.

THE COURT: That's provisionally admitted Plaintiff's

Exhibit 1, just to be clear?

MS. RUDOLPH: Yes.

THE COURT: Okay, thank you.

BY MS. RUDOLPH:

Q. In that document, that document describes the most pressing issue stemming, that the most pressing issue that this was looking at stems from the uncertainty in the detection front of Asian carp in the Illinois waterway, is that accurate?

A. Yes, that was the goal. That was already the established goal of the consortium of management agencies that were working with the Army Corps of Engineers long before we got involved in the cooperative agreement with the Corps.

Q. Now, there is a distinguishment made in this document between what was characterized as a detection front and an invasion front?

A. Yes, the distinction that we would have in mind there is that it links back to what I said earlier under direct examination. Every detection tool has a limit, so even the most sensitive tool, unless it's perfect, and I'm not sure I ever met a detection tool that is, has, that means that all you can say with confidence is that where you have detected it, given your detection limits, the invasion front is at least as far along as that. The invasion could very well be farther along than that, but you don't have a tool sufficiently sensitive to detect it. That's the distinction that we are making.

Q. And in this report the distinction that's made between invasion front, is that invasion front is considered the self-sustaining population and the detection front is few individuals?
A. That would be a subtlety. There is really, there is no -- I don't know that that distinction would be common scientific parlance. We would have to say that's what we mean by that. And actually, I'm forgetting if that's what we defined it as, and I take your word for it.

So there would be two things then that we could be talking about. One is you could think about the invasion front, and this is the spirit in which I gave my first answer to your question, talk about the invasion front as just where is the foremost individual or individuals of the target species, silver or bighead carp, or you could think about it under a more stringent definition, where is there evidence of establishment.
Q. Now, this report seemed to be speaking about the detection front in terms of few individuals being potentially being above the electric barrier. You nodded your head. Could you --
A. We are still referring to the risk assessment report provided in July?
Q. Yes.
A. Yes, I'm sorry, repeat -- was that a question?
Q. The question was that it referred to a detection front, meaning few individuals above the electric barrier?

A. By "detection front" in that context what we mean is simply what's the uppermost, again "uppermost" meaning closest to Lake Michigan, point, geographic point at which we have gotten a positive result.
Q. But you mean individuals, you don't mean a self-sustaining population where you're using that term?
A. Correct, absolutely because detection front would simply be about DNA, and, of course, as I have said repeatedly, we don't know any individuals that DNA evidence alone indicates.
Q. Now, let's talk about the detection of Asian carp specifically with, you know, to the Chicago Area Waterway System, which you obviously have some experience with.

Now, as you previously testified to, the Army Corps of Engineers asked you to come up with and work with this eDNA method and conduct sampling of the Chicago Area Waterway System, right?
A. As I previously said, we entered into a cooperative agreement with the Army Corps of Engineers to do that work.
Q. And you briefly sort of touched on this, but just to be clear, there are, as you said, there are advantages and shortcomings to every sort of detection method that's available for detecting aquatic species, right?
A. Correct.
Q. Let's talk a little bit about, I think you spoke a lot about the advantages of eDNA today. Let's talk just a little bit about

some of the shortcomings of eDNA.

Again sort of looking at the risk assessment that you provided to the Corps of Engineers, that risk assessment discusses the fact that the functional relationship between the number of positive detections and the number of fish present in the system is unknown, is that accurate?

A. Correct.

Q. And that one of the limitations of eDNA is that there is no way of measuring the relative abundance of fish producing the detection signal, the number of positives, without additional experiments?

A. Yes, I think it's also important to say that when we talk about limitations and strengths, we are always talking in relative terms. So if we talk about the limitation of DNA, including not being able to relate it directly to the number of fish, you still have to put that in the context of having detected the presence of a fish when in fact the other available tools were not sensitive enough to detect that presence.

Q. So sort of a shorthand of sort of summarizing this might be to say that the eDNA results at the current time do not tell us how many fish might be in the area at that time, they don't give us the number of fish?

A. Correct. From the very first presentation I think I made to the Army Corps in talking about this, I emphasized the need to couple the surveillance with experiments that would allow us to

better understand what the eDNA results might mean with respect to numbers of fish. The presence or absence is important information, but, of course, what we would all very much like to know is how many fish.

Q. And the eDNA results also don't tell us how that fish got there, assuming that, you know, it really means there is live fish there?

A. No way that eDNA results are ever going to tell you how a fish got somewhere.

Q. And as you have already testified, there are other possibilities out there for the presence, you know, that exists for the presence of eDNA other than live fish, possibilities?

A. Possibilities, considering other evidence not very plausible.

Q. Now, you're aware also that the Battelle Corporation is performing an independent external peer review of the eDNA method?

A. Indeed. We have cooperated with it. It is the subject of one of the other modifications or additions to the cooperative agreement under which we operate with the Army Corps of Engineers.

Q. And peer review is part of insuring that a scientific method is reliable and valid, right, as a general sort of term?

A. In general, yes, of course.

Q. And publication in a scholarly journal, that's also very important?

A. Yes.
Q. And replication by other labs, that's also another component that's important?
A. That's usually not seen as part of peer review, but, of course, that is an important goal for any science that one does.
Q. Now, you also discussed today on your direct the EPA audit that was conducted of the eDNA method?
A. Yes, that's the first peer review that was done.
Q. And that audit states in it that the audit did not address the interpretation of eDNA results in regard to the presence or absence, proximity, or abundance of silver or bighead carp, the presumed source of the eDNA, correct?
A. Yes, I believe that's correct.
Q. And that the interpretation of the eDNA results require additional research in order to understand the relationships between the analytical results, the abundance of fish, and the conditions of the sampled water bodies?
A. Yes, in terms of addressing this issue of how a positive result might relate to the number of fish, yes.
Q. Now, this is -- I'm going to -- this is the risk assessment that you submitted, correct, up on the screen?
A. I'll take your word for it.
THE COURT: Can you tell us what page that is and maybe help counsel find it?
MS. RUDOLPH: Page 40.

MR. REICHEL: Your Honor, just in case Dr. Lodge can't read it, may I give him a copy?

THE COURT: Sure, I think that's fine.

BY MS. RUDOLPH:

Q. And that's just the figure that I was actually putting up here. Now, that figure is an example of what eDNA band looks like, what you're reading when you're looking at positive versus negatives, correct?

A. Well, I would have to look again to remind myself exactly what this is, but it is a picture of an agarose gel, which is the typical highly conventional way to visualize results of PCR reactions.

Q. Now, and this is be labeled as Figure 9 in the risk assessment just for the record.

In terms of these bands, if it's a faint band, that requires an amount of professional judgment to be able to read whether it's a positive or a negative, correct?

A. Yes. There is a certain amount of subjectivity that enters into the final judgment looking at these gels. That is one of the points on which the EPA audit suggested improvements, particularly in a way of taking photographs and better, more objectively evaluating whether it's a positive or negative.

Very rarely in practice in this project has there been any degree of confusion about whether it's positive or negative and in fact, we have multiple people look at the same gel without

knowledge, in blind, in a sense, to make that determination. And again, these are absolutely the standard practices.

Q. Now, your eDNA results, and by "your" of course, I mean the collaborative group, but the eDNA results are being used to target fishing exercises, sampling, and monitoring in the Chicago Area Waterway System, right?

A. The management agencies have chosen to do so, yes.

Q. Now, looking also at this report again, on Page 38 of this report I believe you're citing to McDonald 2004, but it says that: "In the case of rare species, the only solution is to change the detection methods to increase the detection probability and/or increase sampling efforts."

A. Can you tell me exactly where we're looking? This is a page that actually doesn't have a page number on it?

Q. It's Page 38, the sentence above the eDNA method.

A. "In the case of rare species, the only solution is to change detection methods to increase detection probability and/or increase sampling effort," yes.

Q. Now, netting and electrofishing can work and can be effective in certain water bodies, correct?

A. It depends on what your goal is. It is not a tool that is very effective at sampling rare species. It is a traditional and highly effective tool for monitoring the abundance, at least in a crude way for populations that are catchable. On my own research team I have an electrofishing boat, we have nets, we use them,

but they're not appropriate for the goal of trying to identify an invasion front where by definition species will be rare.
Q. And, for example, electrofishing works well where the stream or canal is shallow, right?
A. It works better in that situation than where water is deep.
Q. And one could use, I believe they're called larval fish tows, which are certain nets that are designed to, less mesh to sort of collect larva or eggs in the waterway?
A. Often it's not a tow, it's a net that you push in front of a boat in order to catch larval fish, but yes.
Q. Now, and this is again a general question, but it's sort of appropriate to use the appropriate tool in the toolbox for the job?
A. Of course. I guess I really should ask what does "appropriate" mean and what job we're talking about, however, so I'm not quite sure what that last answer meant.
Q. Now, other than the eDNA results and the one live fish that was caught in Lake Calumet, there hasn't been any other evidence of Asian carp above the electric barrier right?
A. I'm sorry, say it again.
Q. Other than the eDNA results and the one live fish that was caught in Lake Calumet, there hasn't been any other evidence of Asian carp above the electric barrier?
A. I believe that's correct.
Q. And other than the eDNA results in Lake Michigan, the Calumet

Harbor I think that you described earlier, there hasn't been other evidence of Asian carp in Lake Michigan?
A. To the best of my knowledge, that's true.
Q. Now, looking at the potential for the establishment of Asian carp specific to Lake Michigan, scientists currently disagree a little bit about the potential for the establishment of Asian carp in the Great Lakes, right?
A. I don't know whether disagreement would be appropriate. I think everyone to whom I talk and every statement I read acknowledges a great deal of uncertainty about what parts of the Great Lakes might be most at risk from an invasion by either silver or bighead carp.
Q. In fact, you are involved in an ongoing study specifically looking at that potential for establishment, right, with NOAA?
A. We have a number of research projects going on. We have two new projects that might fall in the category of what we are thinking about. One is funded by NOAA and EPA, which is focused on forecasting the potential occurrence and spread and impact of a variety of invasive species in the Great Lakes, that's the overall goal. One of the species and one of the pathways that we highlighted in writing that proposal three years ago was the Asian carp in the canal.

In addition, we have another new project funded by the Great Lakes Restoration Initiative to partner with the Fish & Wildlife Service and state agencies to develop, further develop

the eDNA tool as a surveillance tool throughout the Great Lakes with a focus initially on those rivers that would appear on the basis of previous analyses to be at the highest risk of invasion by silver or bighead carp.

Q. Now, you're also aware that there are studies that are ongoing that are looking at the potential for Asian carp being able to eat alternative food sources in Lake Michigan. Are you aware of those studies?

A. Before we talk about alternatives, we would have to define what the first category of --

Q. Alternatives to plankton.

A. Well, so both silver carp and bighead carp are planktivorous, with silver carp typically eating smaller particles or including more small particles than bighead carp in their diet. Both species, though, are generally described as being planktivorous. However, for these species and almost any other species of fish we would talk about, the typical designations we get have to be regarded with a certain degree of caution because in practice fish are usually much more Catholic in their diets or can be depending on the circumstances than the way in which we initially categorize them.

Q. And there is at that time least one scientist who has referred to Lake Michigan as a plankton desert, modelled that in fact.

A. Yes, I don't remember exactly who might have used that

phrase. I have seen it quoted in a paper by Sandra Cook and co-authors.
Q. So there are studies that are sort of looking at that and are also looking at the potential for alternative food sources in Lake Michigan. Are you aware of those studies?
A. I'm aware of Sandra Cook's, at least one of her papers. I think she's published at least two on this topic. I'm sure I'm not aware of some studies that are ongoing, so I'm not quite sure -- you can ask me in particular about a particular study or scientist, and I'll tell you what I know.
Q. You mentioned earlier the 22 tributaries that were identified as potentially allowing for, to be Asian Carp habitat around the Great Lakes as potentially providing that?
A. Yes, although usually, when those tributaries have been highlighted as potential spawning habitats, so when we talk about habitats, it's probably best to distinguish, particularly for these carp who spawn in one place and typically live most of their lives in another habitat, it's important to distinguish for what purpose the fish may be using a habitat.
Q. And you're aware that USGS is currently taking a further look at those particular tributaries that were identified, as you say, for spawning to further refine and more thoroughly looking at whether or not Asian carp could in fact use those tributaries?
A. We are in frequent communication with USGS scientists about what their goals are and how to go forward in our project and

their project and other projects as we become aware of them so that projects are as complementary and mutually beneficial as possible.

Q. Now, assuming that Asian carp could establish a reproducing thriving population in Lake Michigan, scientists disagree about how long such establishment could take, correct?

A. Again, I would not characterize what discussions and statements that I'm aware of as disagreement. There is, as far as I know, uniform agreement that no one can predict with great certainty what the pace of any potential invasion might be. We have examples of invasions by all sorts of organisms that happen apparently rapidly, and we have many examples of invasions that play out very slowly, that is, people become aware of a species only quite a long time after the species clearly became established, but we only recognized that in hindsight.

Q. The history of the Asian carp invasion of the Mississippi River Basin followed a pattern of a population lag phase of several generations, which took decades before the population entered an exponential growth phase, correct?

A. Maybe. There is a discussion in the biological literature, there is a number of recent papers about lag phases. I think we have to be cautious about distinguishing a really biological phenomenon, that is, populations may grow slowly initially and then ramp up, and that's typical, but it interacts with another important phenomenon, which is humans' ability to detect

something or even their efforts to detect something also has a lag.

So that we often don't look or even don't recognize an invasion until long after it's happening, but in hindsight we recognize, oh, we actually saw that or we should have known that was there.

So yes, those two things together often mean that the recognition that an invasion has happened and that the impacts are occurring often happen long after the population was established.

Q. Now, you're addressing the potential Asian carp invasion into Lake Michigan from the perspective of an ecosystem manager and an invasive species scientist, correct?

A. No, I'm addressing it as a scientist trying to the best of our abilities to work in close coordination with the management agencies who bear the responsibility of making decisions and implementing them.

Q. Now, the perspective of a scientist does not take into account that the waterway must be maintained for navigation, does it?

A. Again, my role and the role of our research team that's been working on this has been to provide scientific information about the Asian Carp and about what our understanding, what our reading of the literature, what our knowledge of fisheries biologists, what our eDNA research has to say about potential management

options. We may speak sometimes about management goals when it's already clear that there is a goal that has been established through the appropriate means of management agencies and public discourse and our democratic process.

Q. You spoke today about specific things that you thought would, specific remedies that you think should be considered. But again, those recommendations don't take into account that the waterway must be maintained for flood control, do they?

A. What I have based my statements on in part is a, what's often referred to as the Canal or Asian Carp Summit in 2003 in Chicago that was sponsored by a variety of government agencies, including management agencies, that brought lots of stake holders together and produced a report with a strong recommendation that ecological separation -- I'm not sure whether that was exactly the term that was used, but the idea was a long-term solution for the waterway was to manage it differently to minimize the ability of organisms, any organisms, to traverse the waterway. So that's the context in which I have sometimes spoken about it. I'm not sure whether that's --

Q. Well, you spoke today about, you know, closure of the locks, but you didn't take into consideration when saying that the need to allow for the passage of emergency vehicles through those locks, did you?

A. The question that I was asked was whether if you close the gate, it will make it harder for a fish to traverse the waterway.

The answer to that is clearly yes. Are you -- sorry, go ahead.
Q. In discussing the screens, potential for screens covering sluice gates, you haven't looked at the possibility for debris in that screen and the impact to the risk of flooding; that's not something you have looked at?
A. Would you like me to look at that? Are you asking me to consider that?
Q. No, I'm saying you have not considered that right now?
A. I have not until this moment considered that.
Q. Now, you are also aware of Fish and Wildlife assembled a panel at the request of the Corps of Engineers to look at whether closing the locks and reducing the number of lock openings would in fact statistically increase the likelihood of Asian carp passing through that, are you aware of that risk assessment?
A. I am aware that it happened. I am not aware that -- if there was a written report, I have not looked at it.
Q. Would it surprise you to know that the majority, in fact more than a majority of that panel, concluded it would not, that the number of lock openings would not statistically reduce the likelihood of Asian carp?
A. I would like very much to see the basis for that argument and logic.
Q. Now, again, everyone here or everyone -- and by "everyone" I mean sort of, you know, the federal family and I think you agree that the name of the game here is to reduce the numbers through

active management of Asian Carp in the Chicago Area Waterway, right, keep the numbers low?
A. Yes.
Q. So we want to keep the propagule pressure low in the Chicago Area Waterway?
A. Right.
Q. And we want to eliminate individuals above the electric barrier, right?
A. Are you asking me whether --
Q. I'm asking you.
A. That seems to be -- that is what I understand of the goal of the management agencies, yes.
Q. And on Page 36 of your risk assessment, I believe it states that management should aim to reduce propagule pressure by reducing access to Lake Michigan, correct?
A. Where are we looking?
Q. I'm sorry, Page 36 here, the sentence above "barrier failure and invasion risk."
A. "Consistent with existing management plans," and we cite the Asian Carp Work Group 2010, "management should aim to reduce propagule pressure by reducing access to Lake Michigan, eliminating individuals above the electric barrier, and reducing abundance below the barrier." That is a restatement of what the management agencies have declared to be their goals.
Q. When you spoke earlier about your figure regarding the

testing of the electric barriers, you were talking about individuals testing the electric barriers, right, individual Asian Carp?

A. I don't think we know whether we are talking about individuals or populations.

Q. Now --

A. Those data were from the USGS records, as I said earlier, except for the uppermost data points.

Q. Now, on Page 28 of this report it also states that the electric barriers constructed and maintained by the USACE on the Chicago Waterway System and additional management activities now being contemplated to prevent Asian Carp successfully invading the Great Lakes should also be as effective at preventing other invasive species in the Mississippi from invading the Great Lakes, is that correct?

A. You're reading the sentence, yes, I see it. It doesn't say how effective, it says as effective.

MS. RUDOLPH: I understand. May I have a moment?

THE COURT: Yes.

(Pause)

BY MS. RUDOLPH:

Q. You also spoke today about the application of rotenone, correct, and rotenone is pretty effective at killing everything in the water column, right?

A. Very effective at killing fish and kills many other things as

well.
Q. And you're aware that rotenone is costly and requires numerous personnel to apply?
A. I am.
Q. And this latest rotenone operation conducted in May of 2010 near the O'Brien Lock and Dam collected about 130,000 pounds of fish, right?
A. I'll take your word for it.
Q. And no Asian Carp were found during that exercise?
A. That's correct. We actually advised against going forward with that rotenoning because of both its cost and our lack of confidence in the presence of carp because as I said earlier, the two previous sampling episodes had really no positive samples in the samples we took.
Q. You're aware that the trigger for that rotenone activity was, I thought the trigger for that activity was the four positives in that area?
A. You would have to ask the management leaders for sure what the trigger was, but it was your understanding and we were in regular communication and continue to be in regular cooperation with the management agencies, that they were prepared to use eDNA results as a trigger for such management actions. However, the timing was not to my mind appropriate, given that the two previous sampling efforts, one of which was just, if I remember right, a couple of days -- I don't remember exactly, but very

close to the event, but we advised not to go forward. We advised the management leaders, who were, seemed to us to be making those decisions, not to proceed because our most recent results did not give us confidence that there were fish in the area and, of course, considering the expense and effort of doing that effort.

MS. RUDOLPH: Thank you, no further questions.

THE COURT: Okay, why don't we take our -- it's right at 3:00, it's a perfect time to take a break, and then when we come back we will see who else has cross-examination questions for Dr. Lodge, okay? So we will take a break until about 3:15, okay? Thank you everybody.

(Recess)

THE COURT: So who else has questions for Dr. Lodge? Mr. Hill?

MR. HILL: I do, but I'm going to defer to Mr. Krauskopf first.

THE COURT: Okay, very good. Mr. Krauskopf, you can go next.

MR. KRAUSKOPF: Good afternoon, Judge; good afternoon, Dr. Lodge. I don't believe we have met before. My name is Stuart Krauskopf. I represent Wendella Sightseeing Company, Inc.

THE WITNESS: Thank you.

CROSS-EXAMINATION

BY MR. KRAUSKOPF:

Q. You would agree with me that in the Great Lakes presently there are over 180 invasive species of fish?
A. No, I would not. In fact, no, that's not true. There are, probably the number you're thinking of is that there are over 180 species by last count, probably 186 or 7 of non-native organisms. Some of those are fish and some of those 180 species would be categorized as invasive, depending on their degree of harm to something that humans care about.
Q. Okay. And I believe, if I understand what I have heard in terms of your credentials, that you have studied more than just Asian Carp, true, you have studied other invasive species as well, correct?
A. Yes, as I said earlier, much of my professional career has been focused on species that have been moved by humans and looking at their actual or potential impacts on the environment, human economy, and human safety.
MR. KRAUSKOPF: Judge, if I may, again, just for the sake of brevity, if I ask a yes or no question, can we advise the witness to just answer yes or no. I don't want to be rude, but --
THE COURT: If you want yes or no answers, then you can get yes or no answers, but the consequence of that is obviously Mr. Reichel will have redirect and he can elicit whatever he'd like.
MR. KRAUSKOPF: With all due respect, I have a feeling

he will have that anyway.

THE COURT: Okay, very good.

MR. KRAUSKOPF: But I appreciate that. Thank you so much.

THE WITNESS: I'll aim for brevity.

MR. KRAUSKOPF: Just if I ask a yes or no question, if you could answer yes or no, I would really appreciate that.

THE WITNESS: If the question can be answered that way, I'll endeavor to do so.

MR. KRAUSKOPF: Thank you so much.

BY MR. KRAUSKOPF:

Q. And I believe you stated that you have written over 800 articles in the areas of fish biology, invasive species, things in that area, correct?

A. I wish I could make that claim. The answer to that is no.

Q. Okay. You have written how many articles in total?

A. On the order of 150.

Q. Okay, forgive me. One of those articles, if I may, and, Judge, for the court's reference it would be, it's attached to Wendella's response to the memorandum or plaintiff's memorandum as Exhibit K, is an article which I believe you co-authored in 2002 with Dr. Cynthia Kolar titled Ecological Predictions and Risk Assessment for Alien Fishes in North America.

Does that sound familiar, sir?

A. Absolutely.

Q. And in this study you and Dr. Kolar actually reviewed the impact of a number of species or potential species on the Great Lakes, correct?
A. Correct.
Q. Okay. One of the species that you discuss in this article is in fact silver carp, true?
A. Yes, alluded to that article earlier.
Q. Okay. Now, I want to just quote from this if I can and just tell me if that sounds familiar to you and that you wrote this.

It says in this article, sir, that "Our models also predict that silver carp," and then it, of course, has the Latin term which I'm not about to try to say, "which has quickly spread through the upper Mississippi/Illinois river systems and sometimes hurts boaters as the fish leap from the water, would neither spread quickly nor be perceived as a nuisance in the Great Lakes."

That is part of your article, is it not?
A. It is. There are other parts of the article that qualify that statement.
Q. Again, if I may, just if you can answer that question, I would really appreciate it.

There has been some discussion today as to whether or not your eDNA research has been per reviewed. Is it your contention that the United States Environmental Protection Agency audit is a peer review of your work?

A. Yes, it is a form of peer review.
Q. And do you know as you sit here today whether or not anyone has had the ability to or you have offered for someone to reproduce your work so it actually could be verified?
A. As I testified earlier, we had an agreement with the Army Corps of Engineers to do just that. That has been our goal. We have fulfilled our obligations under that. As I testified earlier, the Army Corps of Engineers Lab at ERDC and Vicksburg has acknowledged their difficulty in doing so because of, to use their words, problem with pernicious contamination in their laboratory.

In addition, we are working now with the -- with a local company, as I mentioned earlier, who have successfully and without difficulty reproduced results for blank samples provided to them by us. So we are at a preliminary stage of validating their ability to reproduce the results, we are working, beginning to work with the U.S. Fish & Wildlife Service, Fish Health Center in LaCrosse to do the same thing. We have made the offer, again, as I mentioned earlier, to multiple state agencies to do this, and we are committed to working with many agencies to do this.

We have been overwhelmed by requests from state, local, federal agencies, consulting firms, many federal agencies to, to teach them, share with them, or do work with them to use eDNA because they see the high value of doing so.
Q. And you say that you're beginning to do that presently, true?

A. What I said was we are beginning to do that with this local company in South Bend, we are also beginning to do that with the Fish & Wildlife Service. We have been working assiduously with the Army Corps to do that for a number of months, so far without success.

Q. And you would agree with me --

A. Although, let me qualify that. The first round, the first part of our transition plan with the Army Corps was successful. So the lab at ERDC did in fact reproduce our results with the first set of samples. It has been a stepwise transition plan that's laid out clearly in the scope of work with the U.S. Army Corps of Engineers, so the lab did in fact reproduce our results in a set of samples that we took together in the Army Corps as the first step of transition. Since that time when they did successfully reproduce our results, they have been unable to do since then.

Q. You would agree with me that you have held the primers proprietary at Notre Dame?

A. Absolutely.

Q. They have not been released, correct?

A. The primers have been provided to the Army Corps Lab in order for them to do this research. We order them, we receive them in our laboratory, we take the label off to protect the proprietary information, and then we ship them unopened to the ERDC Lab in Vicksburg just as they arrived to us except without the label.

Q. Again, I would ask you if I ask you a yes or no question, simply to answer it yes or no.

THE COURT: Let me intervene on that for a moment, though. Part of this purpose is for me.

MR. KRAUSKOPF: Okay, forgive me, Judge.

THE COURT: And so if he answers a question in a way that's nonresponsive, that's one thing. If he answers in a way that -- the questions don't always lend themselves to yes/no, and that particular one did not.

MR. KRAUSKOPF: Okay, I appreciate that, Judge.

THE COURT: Okay?

MR. KRAUSKOPF: Of course.

BY MR. KRAUSKOPF:

Q. Let's talk about the primers if I may, Dr. Lodge. The primers are something that prior to engaging in your eDNA research is something that your laboratory creates, correct?

A. We don't create them, we design them and have. As any molecular biology laboratory does, we design them and send our specifications to a company that creates them and sends them back to us.

Q. Okay. And those are the primers that are actually used by which to match up samples that are located in water, true?

A. As we discussed in earlier testimony, the primers are part of the raw ingredients to initiate a PCR reaction, which results in the duplication of any DNA in the sample that matches the primer.

Q. Okay.
A. Or is, I should say that is the complement of the primer.
Q. One of the things I don't believe that was discussed earlier today is the issue of false positives and the use of long fragments of base pairs versus short fragments.
You're aware, of course, that if use of a short fragment in a sample is done by the laboratory, that it will hold less DNA evidence than, let's say, a long fragment, true?
A. Strictly speaking, less DNA evidence meaning, I assume you mean fewer base pairs. That doesn't mean less reliable evidence.
Q. Well, it does mean, however, I believe you indicated that you had to or your team had to amplify the shorter strands, true?
A. Amplify is what any lab does in a PCR reaction. Amplify is the verb which describes what a PCR reaction does. That's standard procedure. That's what Ficetola did, that's what every molecular biology laboratory does, that's what we have done. So that's independent from the issue of how many base pairs you're diagnostic fragment of DNA is.
Q. You would agree -- you agree with me that if the primers identify shorter fragments that there is a greater risk of false positive results?
A. I would not agree with that. I think there may be a misunderstanding, though, about what we mean by false positive. It would not be false -- if the PCR reaction multiplies DNA, it was there, so that's not false. Perhaps what you're thinking

about is a well-known tension in making choices when one starts a project like this that revolves around the length of your diagnostic marker. Longer markers are more likely to break down in the environment. So the longer the fragment that you're trying to find, the longer fragment of DNA, that is, the more base pairs of DNA that you're trying to find in the environment, the less likely you are to find it because it will be broken into more pieces than if you're looking in the beginning for a shorter fragment of DNA.

So if you design your marker, if you design your primers to select a marker which is short, your test will be more sensitive, that is, those short fragments will be likely to persist in the environment longer than, for a greater duration in a longer fragment will. So I would say that if you design your primers to identify a shorter marker, you have a more sensitive test. No way would I describe that as in any way false. It's simply more sensitive. You're more likely -- those fragments are more likely to persist in the environment and therefore, you're more likely to be able to detect them than if you're targeting a longer fragment.

Q. So if I understand what you're saying, that in your research that when you locate a fragment of DNA, that would mean that that particular fragment has, has been there for a relatively short period of time or it would degrade?

A. Yes. What we have found and many others have found, in the

conditions like those that occur in a natural waterway near the surface, which is like, a waterway like the waterway system near the surface subject to UV radiation and so forth, DNA degrades and/or is decomposed by bacterial action quite quickly. That's going to apply no matter what length of fragment you're talking about, but it means you're more likely to detect a shorter fragment than a longer fragment.

Q. Are you saying here today that there are no such things as false positives in eDNA research?

A. No, I'm not saying that it's impossible to have a false positive. What I'm saying is the choice of fragment length is independent of any occurrence of false positive. False positives would not result from the choice of your fragment length. They might result from any number of other things that might happen or poor choices that might be made in the process.

Q. Why don't you tell us where, in what circumstances you can find a false positive in eDNA research?

A. Well, you could find false positives if you have any kind of contamination.

Q. And is that the only circumstance in which you would have false positives, Dr. Lodge?

A. It is the most likely circumstance. I'm sure there are other -- you can imagine circumstances -- well, if you have not designed your primers appropriately and you have not screened them appropriately, you could get false positives. If you have

made poor choices in the design of the primers or if you made those choices in the face of too limited information available about the DNA sequence that occurs in your target organism.

In the case of our application of eDNA research to silver and bighead carp, we have exhaustively screened, and the EPA review team exhaustively confirmed, that we have designed the primers to select a fragment which is species specific on the one hand for silver carp, on another hand for bighead carp.

Our fragments that we are designing, that we design for are also much longer, as I said earlier, than those used in the Ficetola work that stimulated us to pursue this.

So, for example, Ficetola's studies, all other things being equal, which they weren't, but all other things being equal, Ficetola's choice of marker would have led him in your terms to have a higher false positive rate than we do. But again, I don't actually even agree with that way of characterizing the situation.

Q. In terms of the rate of degradation, and that would be, of course, how long the actual DNA strand would remain in the water, you have applied, I believe in your declaration you said 6 to 48 hours is how long we would find DNA in the water before it would degrade?

A. What I have said, and I'll repeat, is that we have done some limited, I would regard as largely preliminary experiments, but experiments that give us some confidence, especially in the

context of other published literature, but let me just give you one example of what I would regard as the most relevant experiment that we did, which was to take samples from the field in the routine way that we do so, do our usual eDNA screening, and then for a subset of samples that were positive, put them aside, hold them, and sample them repeatedly over time.

The longest time that passed after which we still got a positive result was two days. For most samples and in most circumstances, in other preliminary experiments we see and in some replicants of that experiment, we see the signal disappearing after a matter of hours.

Q. And I believe, if I'm not mistaken, that these degradation rates that you were using here were actually degradation rates taken from the species of common carp, true?

A. The first experiments we did were from common carp. The last experiment that I described as what I would regard as the most relevant experiment was done with field samples of silver and bighead carp.

Q. And your first studies of actual eDNA were in September 2009 leading up to January of 2010, true?

A. I'm sorry, repeat that question.

Q. Yes, you were talking about your first studies?

A. First studies of what?

Q. Of eDNA in the water were done when?

A. They would have been done in, I believe starting in late

2008.
Q. 2008. And at that time you were using the degradation rates of common carp?
A. Initially, we were working with common carp, and some other species that test primers and markers against for their specificity, but for degradation we were working with common carp.
Q. And common carp are not the same species as Asian Carp, true?
A. By definition, but there is no reason to think that the degradation rates of DNA would differ in any substantial way from those of silver or bighead carp.
Q. But it sounded like you just said a few moments ago that you ultimately had to refine degradation rates into using a different species or different study in order to do this, true?
A. No, we were simply using common carp as a laboratory rat to figure out the appropriate conditions under which this technique might work.
Q. Okay. You have never published your primers to date, true?
A. We have not. We are -- there is a paper, a manuscript in review in a scholarly journal that includes those.
Q. So presently, for example, if Mr. Ficetola would like to have the opportunity to review them, study them, and assess the accuracy of your study, he would be unable to do so, true?
A. It would depend on the communication with Dr. Ficetola and what arrangements we were to make. It's standard practice in

this kind of research to withhold those primers if they're a value to others until you have been able to publish your work yourself first.

But the important point that Ficetola has shown interest in in the statement that he submitted to the court was about the length of the fragment that is amplified, and we have addressed that here.

Q. You have already made as of January -- go ahead, proceed.

A. Thank you.

THE COURT: What's the question?

MR. KRAUSKOPF: I don't know. If the court would like to hear him speak further on it, you know, I don't want to interrupt him, but I would like to move it on if I may.

THE WITNESS: The question was have we revealed the primers. They have been revealed to the EPA audit team. Your question was has anyone else had the opportunity to screen those. The answer is yes, the EPA audit team had full access to all of our information and confirmed that our primers and the fragment that they amplify was species specific to silver on the one hand silver and bighead on the other.

BY MR. KRAUSKOPF:

Q. And you would agree with me that there was not one member of the USEPA team that had any expertise whatsoever in eDNA research or ever studied it in the past?

A. No, that's false.

Q. Which person on the USEPA team had actually studied eDNA in water?
A. What do you mean by eDNA?
Q. I'm talking about eDNA, the research which you're here as an expert on, the research of locating species in water by the use of DNA.
A. Experts on the team are molecular biologists with extensive experience using indirect methods to detect species. In a very strict sense, it's true that none of them had ever used exactly the techniques that we have used in terms of water samples and DNA from those water samples in exactly the way that we have done it.
Q. So let me ask you again then, and just based on people that you know or scientists who have studied eDNA in water, the use of DNA in locating species of water, there was not one expert on this USEPA team that actually had done this in the past before this study, true?
A. Yes.
Q. Thank you. As of January of 2010, the only experts in the area of the use of eDNA in water would be you, correct?
A. False.
Q. Who else would have seen these primers?
A. That's a different question.
Q. Who else would have the ability to --
A. Which one do you want me to answer?

Q. Who else would have had the ability to reproduce your work in January 2010?
A. That's a third question.
Q. Answer the third one.
A. What was it again?
Q. Other than you, in January of 2010, who would have had the ability to reproduce your work in eDNA research of Asian Carp in the Chicago Waterway System?
A. No one.
Q. Nobody. Let's talk about something called calibration. Are you familiar with it?
A. What do you mean by that?
Q. Calibration, a study to be able to determine how many fish are located in areas where eDNA or the DNA of species are found?
A. I think you're probably taking that term from the communication that we have had over a period of many months with the Army Corps of Engineers and other agencies in which it's come to be the term, although it has no sort of technical background in this context, it has no specific definition, but it has come to be the catch-all term that has been used to describe experiments that we have proposed multiple times to multiple agencies now to learn more about what an -- learn more information from an eDNA assessment, including, as you say, potentially the number of fish, but also including very importantly how other environmental characteristics would affect

the eDNA signal, hydrodynamics, degradation conditions, et cetera.
Q. This proposed Exhibit No. 1 titled Aquatic Invasive Species Risk Assessment, do you have that in front of you still?
A. I do.
Q. And again, we are stymied without page numbers --
A. Only every other page.
Q. -- but if you look at page 48, the blank page before 49, do you have that in front of you?
A. I do.
Q. The first sentence says that: "The functional relationship between the number of positive detections and the number of fish present in the system is unknown." Do you see that?
A. I do.
Q. And it confirms what you have been saying, actually quite a few times today, that as you sit here, you're still and you are completely unable to tell us how many fish, Asian Carp, are in the Chicago Waterway System based on your eDNA research, true?
A. I would regard -- yes, I would regard the eDNA evidence as the poorest basis on which to make a designation. Of the available evidence, there are other firmer sources on which to make judgments about number of fish.
MR. KRAUSKOPF: Excuse me for one second, please.
(Pause)
MR. KRAUSKOPF: Forgive me.

THE COURT: That's okay.

BY MR. KRAUSKOPF:

Q. Dr. Lodge, do you remember giving a declaration to the United States Supreme Court in January of 2010?

A. I do. It ruined my Christmas vacation.

Q. I'm going to read you something from that, sir. At Paragraph 46, which you have stated I believe under oath, true, your declaration?

A. I suppose so. I think those declarations were -- I don't know, you tell me.

Q. I'll move on. It says here in your declaration at Paragraph 46, in January of 2010, that: "Based on our understanding of the waterway and other potential pathways, we believe that no explanation other than the presence of multiple living silver and bighead carps can plausibly explain the entire spatial and temporal pattern of positive results for silver and bighead eDNA in the waterway."

Do you remember that statement?

A. I stand by it.

Q. Okay. From a scientific perspective in terms of studies, whether I call them calibration studies, however you look at it, whether there is one fish, zero fish, or multiple fish is scientifically unknown, true?

A. Not completely.

Q. Okay. Sir, when you made this comment that there is multiple

living silver and bighead carps, one thing that I didn't see when I read this was a footnote or a statement or anything below here that says that there should be further study done or a calibration study or anything in order to confirm whether or not there are in fact multiple fish above that barrier, true? There is no footnote, there is no statement, nothing.

A. On many, many occasions over the last few months we have begged and cajoled and written specific proposals to the management agencies to conduct such calibration experiments.

As I said earlier, in my very first presentation to the relevant management groups, I emphasized that the usefulness of this eDNA tool will be greatly improved if simultaneously experiments are funded in order to understand more what information can come from an eDNA signal.

Q. Exactly. Later in that same declaration, you say, and I quote at Paragraph 49: "However, our eDNA results indicate that at least a few individuals of both silver and bighead carp have already accessed to Lake Michigan via the O'Brien Lock and Dam."

Do you see how it's very possible for people who don't understand eDNA research to take this as being a living truth?

A. It is the truth as I believe it, and I believe there is firm evidence for that.

Q. But again, that's as you believe it, not as has been scientifically tested, true?

A. Would you like to know why I believe it?

Q. No. Let's talk a little bit more if I may. I want to talk about this document, which you will have to bear with me a little bit. This was on a slide -- I know I'm only 50, but I don't know how to use this so I'm just going to hold it up if that's okay.

THE COURT: As long as the witness has a copy of it and everybody else knows where you're at.

THE WITNESS: I don't have it in front of me, but I think I know what it says.

MR. KRAUSKOPF: I don't know if it's around. It's the Data Interpretation and Strength of Evidence.

(Pause)

THE COURT: Is that the one?

MR. KRAUSKOPF: That's the one. Thank you. Forgive me.

THE COURT: All I want to do is make sure everybody is on the same page here, and I think we all are now, so thank you.

MR. KRAUSKOPF: Fantastic.

BY MR. KRAUSKOPF:

Q. And this particular document, as I understand it, you have an arrow going stronger to weaker, and you have taken into account various sources of evidence, ideas, and thoughts as to what would be a stronger interpretation of the strength of evidence versus weaker, correct?

A. What it summarizes is the levels of information available for different reaches that bear on inferences that can be drawn.

Q. Okay. What I don't see in here is this rotenone poisoning of

what was it, 6-mile radius in which no Asian Carp were actually found, and I believe -- let me finish -- and I believe that at the time that this was done, no fish Asian Carp, live or dead, had ever found its way above the barrier.

Why is that not in this document?

A. There were at least two parts to that question. As I understood the first part, if it's framed as a question, it would be where is the 6-mile rotenoning in December 2009.

Q. Let's start with that.

A. Is that a question?

Q. Please.

A. That is the second item in the right-hand column.

Q. Okay. And so what you're saying here, because this is where I don't really understand this. You're saying that there is stronger evidence for living fish because of the rotenone captured fish below the barrier? Here, look --

A. Is there -- can you clarify that question, please?

Q. I'll make it easy for you, and again --

A. Yes, just point.

Q. See where it says "Lockport, below the electric barrier, rotenone captured," do you see that, sir?

A. Indeed I do.

Q. There was rotenone poisoning below the electric barrier, right, that's what you're saying here?

A. That is what it says.

Q. And there was a fish that was captured below the barrier, true?
A. There were many fish, including one bighead carp.
Q. Okay. What does that possibly tell the court as to what, whether or not there is a strength of living fish above the barrier?
A. I don't think there is anything about that table that relates to a distinction between above or below the barrier.
Q. Okay, that's what I guess I didn't understand. So this particular document itself does not instruct the court about whether or not you have any feelings, whether stronger or weaker, about whether or not there is living fish above the electric barrier, true?
A. That table was not designed to address that particular point.
Q. If I just wasted your time, forgive me, I didn't understand that.
THE COURT: Can I clarify one thing, though? The netting capture in Lake Calumet is above the barrier, right?
THE WITNESS: Correct.
THE COURT: So this chart has both.
MR. KRAUSKOPF: Right, that's why I'm lost.
THE COURT: I just wanted to make sure I got it.
BY MR. KRAUSKOPF:
Q. So there then there was also a rotenone kill above the barrier, true, near Lake Calumet?

A. South of Lake Calumet.
Q. Okay. Wouldn't it find its way or shouldn't it find its way into the weaker section? The idea that in fact if you kill a hundred and something thousand pounds of fish above the barrier and you don't find one Asian Carp, that in fact that that's evidence that there are no living fish above the barrier, shouldn't it be there?
A. I think there were multiple parts to that question. Let me see if I can do the first.
Q. Please.
A. The title of this table is about evidence for living fish. So it's about positive results. We have discussed in several ways in earlier testimony today the difficulty of interpreting negative results. We have also discussed the evidence that led the management agencies to take the decision to do the rotenoning in the Calumet River that you're referring to. It was apparently triggered by some early positive DNA results, but in fact, as I testified earlier, the two sampling periods closest in time to that rotenoning did not reveal any positive results.

Thirdly, and still in direct response to your question, it is very important to recognize the limitations of rotenone in addition to the limitations of the traditional samples and eDNA that we have discussed.
Q. Okay.
A. This is still directly applicable to your question.

Q. Forgive me, I didn't mean to interrupt.
A. The confidence and relevance of the rotenone.
Q. I apologize.
A. When rotenoning is done, while there is good evidence, lots of rich experience that most, if not all, fishes are killed, it is clearly true that only a fraction of the fish that are killed are actually recovered. So it's important to remember that.
Q. So is it your testimony here today that there is a possibility of dead Asian Carp sitting at the bottom of the Cal-Sag channel or Lake Calumet that could have been killed?
A. Yes, not Lake Calumet. Lake Calumet has not been rotenoned.
Q. In the areas of the rotenone, there could be dead fish at the bottom of that area?
A. They would be long gone now, but yes, shortly after the rotenoning absolutely is possible.
Q. And then I want to make sure I get this one fact. You're saying that at one point you tested in that area where there was rotenone --
A. Later.
Q. -- and there was a positive hit. Later, there were more tests and there were negative hits, true?
A. Yes.
Q. And that would suggest what, that the fish were there at one point for a day or two and left?
A. I don't know about the day or two part, but if you eliminate

the day or two from your question, the answer is yes.
Q. But it doesn't suggest to you that there might have been false positives the first time that you actually did those tests?
A. No.
MR. KRAUSKOPF: Give me one more moment. I'll be done in just a few moments, Judge.
BY MR. KRAUSKOPF:
Q. I want to talk very briefly, if I can, about these alternative explanations for the eDNA in the water. You had quite a bit of time with counsel and you ruled out the alternatives or at least some of them, true?
A. "Ruled out" is probably too strong a term, but I suggested they were less plausible as an explanation of the overall temporal and spatial pattern of results than the presence of live fish.
Q. And you're aware, I believe you said in your testimony that you're aware of this Asian Carp Working Group Control Plan, some 250 page document created in 2007. Are you familiar with that?
A. Yes, at least vaguely familiar, but if we want to talk about details, please provide a copy.
Q. Well, let me just ask you this. Are you familiar with the idea that in that control plan there were a discussion of these alternatives as real possibilities for the presence of eDNA in the water?
A. They remain, as I have said repeatedly, possibilities, but

not plausible explanations of the overall pattern.
Q. Are you aware of the fact that the U.S. Coast Guard has now or since placed restrictions on the release of ballast water passing through these areas?
A. Yes, I referred specifically to that in my earlier testimony today.
MR. KRAUSKOPF: I'm almost done, Judge.
THE COURT: Okay.
MR. KRAUSKOPF: Give me one second.
THE COURT: Sure.
MR. KRAUSKOPF: I just have a couple follow-up questions, if I may.
BY MR. KRAUSKOPF:
Q. You were asked questions about the efficacy of the locks, the Chicago Locks and the O'Brien Locks as using as preventative measures from Asian carp and I believe other invasive species from passing through the waterway system into Lake Michigan. Do you recall that testimony?
A. I do.
Q. You haven't studied that yourself, have you, the efficacy of the locks?
A. It doesn't take a sophisticated study to recognize that a physical barrier can slow fish down.
Q. But as you sit here today, you don't know whether or not that physical barrier actually serves as a complete barrier, do you?

A. I made no claims about completeness.
Q. So there could be areas through the locks where fish, Asian Carp or other fish, could actually swim through in either direction, true, as far as you understand it?
A. The locks that I have seen would be highly unlikely to allow an adult fish to swim upstream.
Q. I just want to make sure that I understand. The locks that you have seen, Chicago Locks and the locks down at O'Brien --
A. Chicago Locks I'm specifically thinking of, are the ones I have seen. But I will not claim to have expertise in exactly the function of any of those locks. I'm simply answering the question about a physical barrier prohibiting fish from moving at least in part.
MR. KRAUSKOPF: Fantastic. That's all the questions I have, your Honor.
THE COURT: Okay, thanks, Mr. Krauskopf.
Mr. Hill, are you next?
MR. HILL: Yes.
THE COURT: Okay, very well.
MR. HILL: Good afternoon, Dr. Lodge, my name is Ron Hill. I represent the Water Reclamation District. I just have a few questions. I hope I don't repeat what everybody has asked. I'm trying to sort it out as we're going ahead here, but I apologize if I do.
THE COURT: Obviously, all of you have to adjust on the

fly in that regard.

CROSS-EXAMINATION

BY MR. HILL:

Q. Dr. Lodge, you indicated in your January 4, 2010 declaration that as of the time you filed your declaration, the traditional sampling efforts for Asian Carp by the pertinent agencies was modest relative to the habitat, is that correct?

A. Yes, I'll take your word for it and I have some memory of that. The testimony you're referring to is the affidavit for the Supreme Court?

Q. Correct.

A. Yes.

Q. And because it was filed the first week of January 2010, your statement obviously did not consider all the increased sampling efforts that have gone on since that time, is that correct?

A. Yes.

Q. And you also indicated, I believe, in your declaration what you refer to as traditional tools for sampling fish such as electrofishing, netting, and poisoning have very limited success where modest sampling effort is expended relative to the area of habitat and the fish numbers are low, is that correct?

A. Yes. I mean, if details are important, perhaps we should refer to specific sections of the testimony.

Q. Did that statement sound accurate? I believe that was in Paragraph 6 and 7 of your --

A. Yes, if you're reading from the testimony, yes.
Q. And your discussion of electrofishing --
MR. REICHEL: I'm sorry, paragraphs 6 and 7?
MR. HILL: Paragraphs 6 and 7 of the declaration.
MR. REICHEL: I'm sorry.
BY MR. HILL:
Q. Your discussion of electrofishing in January 2010 could not have considered the continuous electrofishing of the four extended reaches in the waterway that are now being conducted on a regular basis, correct?
A. I'm sorry, repeat that. Are you reading again from the statement?
Q. Well, your statement was issued in January 2010. Since that time there has been continuous electrofishing going on in four extended reaches of the waterway, are you familiar with that?
A. Yes.
Q. And that would be approximately 75 miles above the barriers that are being continuously electrofished at this time? Does that sound about right?
A. That sounds about right.
Q. Okay. And also, since the time of your January declaration, there has been five fixed site monitoring stations upstream of the electric barriers in the CAWS that are now being monitored for Asian carp by electrofishing and netting on at least a biweekly basis, does that sound correct?

A. These are actions that management agencies are taking. I claim no particular knowledge of that, but yes, I have understood that that's the case.

Q. And isn't it true that both commercial fishermen and the agencies with expertise are constantly tweaking or refining their approach in using these traditional methods to capture fish?

A. That I do not know.

Q. Now, you indicated in your January declaration that it takes extraordinary effort to catch as many as 10 percent of a fish population, is that correct?

A. Yes, that number is based on extensive literature in the fisheries and biological academic studies. 10 percent is the target for -- which is generally regarded as a rule of thumb as the minimum aimed for to do a mark-recapture estimate of a population. The point I was using that to make is that it is extraordinarily difficult even in smaller habitats to achieve that 10 percent recapture, which implies that you have caught 10 percent of the population.

As an example I provided earlier, I mentioned earlier a study recently published in 2010 by Greg Sass and co-authors in which they recaptured less than 1 percent of the silver and bighead carp in a mark-recapture study even with extensive efforts using the traditional, using electroshocking.

Q. So with respect to the ongoing activities that have occurred since your January declaration with the electrofishing, the

rotenone applications, the biweekly monitoring stations that are going on, would you consider those efforts extraordinary?
A. They have certainly increased, and they are extraordinary against -- when compared to the traditional efforts that a management agency typically conducts. Whether they are sufficient to catch even a small fraction of the population of any of the species that exist in the areas that are being fished is uncertain and I think unlikely.
Q. So you don't know at this time, but would you concede that they're more than modest?
A. Certainly, I think we have to be clear about what our benchmark here is . What's the benchmark that you would like for me to compare the effort with?
Q. How do you define "modest"?
A. Let me be clearer. If we are comparing it to efforts that are traditionally applied by management agencies, these are extraordinary. If we compare it to the goal of detecting the invasion front, I think it's unlikely that a sufficient proportion of the population is being caught to have a very sensitive detection limit using those traditional tools even with these efforts that one might regard as extraordinary with respect to what management agencies usually do.

Again, consider that under these circumstances, a very small proportion of the fish that exist are being caught. Compare, for example, I think, and I don't have the numbers in my

head at the moment, but it would be instructive to compare the number of fish that are being caught in netting and electrofishing efforts relative to the number of fish that are recovered in the rotenoning efforts in the same waterways, remembering that many, perhaps most, of the fish that are killed and rotenoned are not actually recovered.

That gives you an index for what proportion of the fish you're catching in a given reach with the traditional methods. You could use that to estimate your detection limit using the traditional tools, and I think that detection limit would not be very good with respect to rare fish, which by definition, if you're looking for the invasion front, we are talking about rare fish.

Q. So you could put it somewhere between modest and extraordinary, is that correct?

A. I can't answer it any more clearly than I just did.

Q. You're aware that over the years traditional sampling efforts have in the past and currently identified a significant number of Asian Carp in the Marseilles Navigation Pool, is that correct?

A. They have caught silver and bighead carp in the Marseilles pool, yes.

Q. And the Marseilles pool is not on this map?

A. Yes, I believe the Marseilles pool is to the left.

Q. Further southward?

A. Yes.

Q. And the next pool north of Marseilles is the Dresden Island pool, is that correct?
A. I believe that's correct.
Q. And you're aware that traditional sampling efforts indicate that the Asian Carp are also present in the Dresden Island Navigational Pool, is that correct?
A. Yes, that is true. That was true before we got involved.
Q. And I believe that you state in your January declaration that management agencies employing traditional sampling tools had shown both species of Asian Carp to be present in abundance in those southerly pools, is that correct?
A. In abundance sufficient to catch them with those traditional tools.
Q. Would you agree that although Asian Carp are present in the Dresden Island pool, that traditional sampling efforts capture significantly fewer carp from the Dresden Island pool than from the Marseilles pool?
A. Yes.
Q. Isn't it true that Asian Carp, and I believe that was indicated on one of your prior exhibits, were first detected in the lower reaches of the Illinois River over a decade ago?
A. Yes.
Q. And isn't it true that Asian Carp have been captured in the Dresden Island pool since at least 2002?
A. I'll take your word for it.

Q. I think it was in one of your prior exhibits.
A. I think when we are comparing efforts, however, it's very important to compare on the basis of effort, so I'm not sure where we are going with this.
Q. I'm just asking if they were actually detected through traditional sampling methods as far back as 2002 in the Dresden Island pool?
A. I'll take your word for it, yes.
Q. If you look at the next navigational pool moving northward, that would be known as the Brandon Road pool?
A. Correct.
Q. And you note in your January 2010 declaration that there has been no recovery of Asian Carp from the Brandon Road navigational pool, isn't that correct?
A. Except for -- the capture of a fish, but as we discussed earlier, the sighting of a silver carp.
Q. And that was one carp, I believe you indicated?
A. That was one carp prompted by our eDNA results.
Q. So as of today there still have been no carp captured, but there has been one sighting in the Brandon Road pool?
A. I believe that's true, but again, it's very important to talk about effort when you talk about catch. You won't catch any fish if you don't try.
Q. So the Asian Carp have been recovered from the Illinois River using traditional methods for a decade and the Dresden Island

pool since at least 2002, but they have not been recovered from the next pool going north, the Brandon Road road pool, is that correct?
A. Correct.
Q. And the navigational pool directly north of the Brandon Pool pool is the Lockport pool?
A. Yes.
Q. And are you aware to date that only one Asian Carp has been captured from the Lockport pool and there was downstream of the barrier?
A. As we discussed earlier, yes, I'm aware of the rotenoning, again, important to talk about effort.
Q. You indicated in your declaration, I believe it was paragraph 48, that "Establishment success is positively related to propagule pressure," do you recall that?
A. Of course.
Q. "And an important component of propagule pressure asserted by the Asian Carp is the number of carp," isn't that true?
A. That is what we generally mean, we biologists mean, when we are talking about propagule pressure, is the number of individuals and also often the numbers of times in which individuals are released or have the opportunity to move.
Q. So is it a fair statement to say that judging from traditional monitoring results, the propagule pressure appears to decrease as one moves northward on the Illinois Waterway toward

the Brandon pool and Lockport pool?
A. I have not seen an analysis rigorous enough to make that statement with confidence.
Q. What would it take for you to make that statement with confidence?
A. A rigorous evaluation of catch per effort of fishing.
Q. So based on the numbers that you have seen and all the efforts that have been discussed here today, as you sit here you can't make that statement?
A. It seems to me that that's likely to be the case.
Q. Thank you. Where in the Illinois Waterway in relation to Lake Michigan is the closest known reproducing population of Asian Carp?
A. I am not confident of the answer to that. The kind of evidence that one would use in that regard is the presence of young of year fish. I believe it's true that that's the case in Marseilles pool, but again, I'm not confident of that answer and one has to be very cautious about the likelihood of capturing fish.
Q. So as you go down the map from Dresden down to Marseilles and further south, you couldn't answer that question for certain at any point on the Illinois River?
A. You'd have to catch a large number of fish to be confident about whether, what the age classes of fish are that are present and whether in particular to address your question, young of year

fish are present, which would indicate that spawning and successful reproduction had occurred in that location or somewhere upstream. One has to remember in this waterway which direction the water is moving, so if you were to capture young of year, one would assume that they were spawned somewhere upstream.
Q. So you're not able to answer that question?
A. I am not.
Q. In your investigation of the Asian Carp, have you ever reviewed Chlorophyll-a concentrations in the navigational pools on the Illinois Waterway?
A. I'm sorry, repeat the question.
Q. In your investigation of the Asian Carp, have you ever reviewed Chlorophyll-a concentrations in the navigational pools on the Illinois Waterway?
A. It may be the case that one of the members of our team has accumulated data that might be available. We certainly talked about it, but we have not analyzed rigorously Chlorophyll-a data.
Q. Do you know what the significance is of Chlorophyll-a concentrations?
A. I believe it would depend on the goal of the study, but Chlorophyll-a is a typical metric for, or a typical index that's used to indicate the abundance of phytoplankton.
Q. Are you aware that Chlorophyll-a concentrations drop dramatically as you move northward on the Illinois River?
A. Yes.

Q. Thank you. Dr. Lodge, how many eDNA samples were taken in 2010 above the barrier?
A. I'm not completely sure about that. Somewhere on the order of, oh, probably 500, maybe as many as 600, but not sure about that. Have to consult my notes on that.
Q. Out of these 500 to 600, how many were positive for silver carp?
A. Well, 450 of those samples have yet to be fully analyzed, so right off the bat, most of those we can't address, and as to the ones that have been reported, I don't know, I would have to look at the records. We have reviewed earlier the general patterns, but I cannot tell you off the top of my head the specific number of samples.
Q. I'm sorry, then for 2010 how many samples have been analyzed?
A. I cannot recall with confidence how many samples we have fully analyzed and therefore reported to the Corps.
Q. In your testimony you referenced multiple hits on the same day, I believe, is that true?
A. For some reaches, yes.
Q. The eDNA analysis does not tell you if the eDNA is all from the same fish or from different fish, does it?
A. Correct.
Q. And you also used the term "invasion front," I believe. Is there a certain number of fish that constitute an invasion front from a scientific perspective?

A. As we discussed in previous rounds of questions this afternoon, we have to be very clear about what we are defining as the invasion front. We have talked about three possibilities this afternoon, a detection front, which is simply where is the northernmost spot in which we get a positive DNA hit if we are talking about detection with DNA.

We could talk about invasion as the occurrence of organisms, any organism of the target species that the minimum estimate of that might correspond to the eDNA detection front, or we could talk about where there is evidence of establishment, which gets to your previous question about where is reproduction occurring.

Q. Does that tie into the abundance issue also?

A. Can you clarify that question.

Q. Well, I think in one of your declarations you talked about the abundance of fish in Marseilles and Dresden. Does the invasion front -- strike that.

Can you place the invasion front on the Illinois Waterway at a certain point in your opinion?

A. If we define it as a detection front, that's very straightforward. It would be Lake Michigan or the Calumet Harbor sample would be the location closest to Lake Michigan, or indeed, depending on how you define it, in Lake Michigan where we found it, when we found DNA. If you defined it in other ways, the answer would be less certain.

Q. Could you answer the other two ways, define it?

You said if you looked at it, there are three ways to look at it. You just told me one way to look at it.

A. Well, if you say "invasion front" as where is the northernmost detection? Well, the northernmost detection is eDNA detection front, so that's the same.

If you say where is there evidence of establishment, that's somewhere downstream, and again, we have already ascertained that I'm not sure exactly where that is, and it would be highly uncertain based on the kinds of sampling and effort that's been put in.

Q. I just have one more area of this, which may have already been touched on so I'll be brief, but you previously had some testimony about the installation of gates or screens on sluice gates, and I believe you indicated you're not an engineer, is that correct?

A. Correct.

Q. And you didn't study the feasibility of installing gates or screens on the O'Brien Lock and Dam, the Chicago River Controlling Works, or the Wilmette pumping station, did you?

A. No.

Q. And you didn't visit the specific locations and look at each structure to determine what would be involved in doing so, did you?

A. No.

Q. And you didn't determine what size grates and screens would be effective, did you?
A. No.
Q. And you didn't evaluate the impact that your recommendations may have on flooding, did you?
A. No.
Q. How about on water quality?
A. No.
Q. Navigation?
A. No.

MR. HILL: Thank you.

THE COURT: Okay, thanks, Mr. Hill.

Mr. Rieser.

MR. RIESER: Thank you, your Honor, Dr. Lodge, and I will try and keep it brief and --

THE COURT: Hopefully, we are filtering -- as your fellows cover the territory that you would have covered, just kindly cut that out and we will go on to the points you've got left.

MR. RIESER: You bet.

THE COURT: Thank you, sir.

MR. RIESER: Dr. Lodge, my name is David Rieser, law firm of McGuire Woods.

CROSS-EXAMINATION

BY MR. RIESER:
Q. Looking at the chart, the Data Interpretation Strength of Evidence for a Living fish, the items at the top under the stronger involve areas where you have been able to correlate an eDNA finding with a live fish, is that correct? Would that be a correct interpretation of it?
A. Yes, that is evidence that satisfies the most people.
Q. Okay. The fish that was found in the vicinity of the O'Brien Lock and Dam, I think you testified a number of times that there were no positive eDNA hits during 2010 in that area?
A. Not in Lake Calumet. Yes, correct.
Q. Okay. And the samples, based on one of the other exhibits, that show positive hits for that area were all of silver carp, isn't that correct?
A. Yes.
Q. And the fish that was found in the vicinity of the O'Brien Lock and Dam was a bighead carp?
A. The fish recovered in Lake Calumet was a bighead carp.
Q. In what way does the silver carp eDNA found six months before the location of the bighead carp in Lake Calumet correlate that eDNA data?
A. It doesn't. What we are referring to on that table and with the vicinity of O'Brien Locks is referring to the bighead carp positive results, which we have had multiple times in the region especially south, south of O'Brien Lock.

Q. So looking at the Cal Riv segment on this exhibit, which is the sampling results from 5-13-10 report, the Cal Riv, I assume that's the segment of the Calumet River right in the immediate area of the O'Brien Lock and Dam?
A. We would have to look back at the map for sure, but I believe that's the section that is above the O'Brien Lock and Dam.
Q. And that shows no detections --
A. Of bighead.
Q. In '09, no detections for bighead and multiple positives only for silver carp in December of '09?
A. Correct. That's what I just referred to.
Q. And in the area below that -- okay.

In your statement -- we have talked a lot about the statement that you have presented to the Supreme Court, which I believe is Exhibit 14 to the brief submitted by the states. At Paragraph 38 you make the statement that: "The confidence that eDNA indicates the presence of at least one individual live fish of a target species applies especially strongly to locations where we have detected eDNA on multiple sampling trips," and then continues.

When you use the word "confidence" in that sentence, you're using it in the context of your personal confidence and your results, not in statistical confidence, isn't that correct?
A. No, I would disagree. No, I'm using confidence in the context of the kinds of evidence that scientists would usually

regard in a context like this of interpreting the presence of fish.

Q. Had you performed a statistical evaluation of your results and identified a margin of error at the time that you wrote this in January of 2010, it would allow you to derive a confidence level, a statistically reliable confidence level?

A. I'm not aware of a relevant statistical test or what confidence level you refer to that one would do. We have in the context of confidence in this case what is relevant is all the quality control and quality assurance approaches that we use to guard against the possibility of false positives. Those are the relevant considerations with regard to false positive.

Q. At the time -- well, you're not saying that there is no methodology, statistical methodology for evaluating the data set that can provide a statistical confidence level with respect to the -- with respect to that data set and how accurate it is?

A. There are, of course, hundreds of statistical tests, each of which has a realm of relevance. So we have to be very specific about what hypothesis we are testing when we talk about a statistical test, and it's unclear to me what you have in mind.

Q. Did you perform any statistical test with respect to your data as of January 2010?

A. As I said, I'm unaware of any statistical test which would get at the relevance or confidence about whether a test that we have conducted is detecting the presence of DNA in the water. If

that's the hypothesis we're testing, a statistical test is not relevant. What is relevant is the quality assurance/quality control techniques that we have employed exhaustively in our laboratory and that were validated by the EPA audit of our procedures.

Q. I would like to be clear, as of January 2010 you had not performed a statistical test with respect to your data?

A. That question is unanswerable without reference to what hypothesis is being tested.

Q. Proceeding on in your Supreme Court statement, you make the statement at paragraph -- I'm sorry, Paragraph 40, you discuss the meaning of negative results and you say, as I think you have said here today, "A negative result does not necessarily imply that no silver or bighead carp are present. It means only that the concentration of eDNA was lower than the detection level of our current eDNA protocols." Do you recall that, sir?

A. Yes.

Q. At the time that you made the statement in January of 2010, had you identified detection limits for your current eDNA protocols?

A. You would have to say detection limits with respect to what. We have done analyses in the laboratory to assess how much DNA it takes to give us a positive hit, but that's not the relevant detection limit with respect to the issues that are under consideration here today. Rather, the detection limit that's

relevant to these considerations is how does DNA relate, the DNA signal relate to the presence, which we have, I think, established and to the abundance of fish, which we have not established.

Q. I think it's a very simple statement, it means only that the concentration of eDNA was lower than the detection limits of our current eDNA protocols, these are your words. What detection limits were you discussing when you wrote them?

A. The second --

Q. Excuse me, and had you done any scientific evaluation to arrive at those detection limits?

A. It was the second category of detection limit that I was referring to, and no, we have not had the opportunity despite repeated attempts to garner the resources necessary to do such calibration studies.

Q. When you say "the second," you're referring to --

A. The relationship between DNA positive results and the abundance of fish.

Q. And abundance. And it says, the sentence before, "A negative result does not necessarily imply that no silver or bighead carp are present, it means only that the concentration of eDNA was lower than the detection limits of our current eDNA protocols." So not to argue, but that refers to the presence or absence of one fish based on a negative result?

A. I'm not sure I understand -- well, you didn't ask a question.

I'm not sure I understand your statement. You seem to want me to answer, so maybe you could clarify the question.
Q. I'll move on. Was it a finding actually of the EPA lab report, one of their criticisms of your work, that you had not identified a detection limit at the time that they did their evaluation in, well, they wrote the report in February of '10.
A. Was that a question?
Q. Yes.
A. I'm sorry, repeat.
MR. RIESER: Would you read it back, please.
(Record read)
BY THE WITNESS:
A. I'll take your word for it if that's what was said, although I do remember that the, I think "criticism" would be an inappropriate term because there were various recommendations and they were described as such in the EPA audit report.
I don't remember, I don't recall whether, which detection limit was being referred to at that point. I'm sure we discussed both.
BY MR. RIESER:
Q. It states that the audit team -- this is at VI of the EPA report -- "The audit team was unable to assess the potential for false negative PCR results (failure to detect Asian Carp eDNA when it is present in the sample) because the laboratory has not yet conducted the experiments necessary to estimate sensitivity

limits of the eDNA detection protocol."
A. Again, I'd have to probably read a little bit more of the context there to be completely sure, but I believe that's probably referring to the first category detection limit, that is, how much DNA needs to be in a sample for us to detect it.
I believe that we have done experiments since then to do that, but I don't recall the details of those. The more relevant detection limit is about how does that relate, how does our ability to detect DNA relate to abundance of fish.
Q. You have answered a number of questions as a scientist, but you would agree with the statement that as a scientist one of your goals is to be able to produce work that is reproducible by other scientists, correct?
A. Yes.
Q. Was it not one of the findings of the EPA audit that at the time they did the audit, your work was not reproducible?
A. Yes.
Q. It was also a finding that at the time of the report you did not do any sequence analysis confirmation, and they recommended that you do that sequence analyst confirmation and you agreed to do that for some percentage of your samples, do you recall that?
A. Yes.
Q. What does sequence analysis confirmation do that you weren't doing at the time they recommended it?
A. It is just one additional step to confirm that what you are

seeing on an agarose gel, which is the way to visualize the results of PCR, is in fact what you think it is. It's a double check on the specificity of primers and markers. We have done that, and in every case it has confirmed the original interpretation.

Q. If you recall that Dr. Ficetola in his paper that you have cited to indicates that he did sequence analysis confirmation on some proportion of his samples, correct?

A. Yes.

Q. But you chose not to do that in establishing your protocols for these samples until the EPA recommended it?

A. Up until that time we had not done so.

Q. I'm sorry?

A. Up until that time we had not done so.

Q. The material that has been proffered as I believe Plaintiff's Proposed Exhibit 1, that doesn't contain -- that doesn't remotely contain all of the data you accumulated with respect to the eDNA sampling activities over the past year, correct?

A. No. The scope of work that this report, Plaintiff's Exhibit 1, addresses is really the first initial scope of work under the cooperative agreement with the Army Corps.

The results from the regular, what became a regular eDNA surveillance was reported in very regular and very frequent written reports to the Army Corps.

Q. And the data that was reported to the Army Corps included the

exact location of the samples, the date and time of the samples, the chain of custody for samples, is that correct?
A. Some of that, but not all of that information.
Q. Which was included?
A. Well, let's step through them. You ask me.
Q. I'm sorry?
A. Let's step through them. Which do you want to know?
Q. Let me ask you since it was your data, what data was presented to the Army Corps with respect to your --
A. I think it changed a little bit over time. There were in many cases, especially later on when we got requests from the management agencies for more specific information when rotenoning or electrofishing or netting was contemplated, we provided maps and as detailed information as was requested that was relevant for those management decisions.

Early on, before those things were contemplated, I believe we did not supply as much information.
Q. As of the eDNA sampling in May of 2010, with respect to that sampling, what data did you provide the Army Corps of Engineers?
A. For that particular May 2010 sampling?
Q. Correct?
A. You know, I'm not sure I would recall in detail. I'm sure we have the reports present, be happy to look at one.

(Courtroom lights dimming).

THE COURT: They'll come back on. I didn't do it.

(Laughter)

MR. RIESER: Thank you, your Honor. I appreciate that confidence, your Honor.

(Laughter)

THE WITNESS: I'll be happy to look at the report with you.

BY MR. HILL:

Q. I'm sorry, I didn't hear that.

A. I would be happy to look at the report with you.

Q. Well, I would be happy to look at the report also, but I haven't seen it.

Are you aware of what reason the Army Corps might have for not sharing with other stake holders the information that's contained in that report?

A. Those reports provided in recent, the most recent months have been provided not only to the Army Corps, but to other management officials, certainly including the Illinois Department of Natural resources, John Rogner and others, as a result of our request to the Army Corps to agree that it was a good idea to provide those reports to more agencies than just the Army Corps.

Q. Do you have an understanding of why that information has not been provided by any of those agencies to public stake holders?

A. Those -- there have been numerous Freedom of Information Act requests to which we have, when asked, have always agreed. There have been times when we have --

Q. I'm sorry, let me follow up on that particular thing. When you say you agreed, does that mean that you have turned over to the Freedom of Information requester all of your data with respect to locations of the samples, quality assurance, quality control data regarding the sampling, how many samples resulted in amplification, and how many did not, all that information was turned over?

MR. REICHEL: Objection, compound. It's a whole laundry list of things.

MR. RIESER: I appreciate that, your Honor. On the other hand, the witness has asked me to provide a list of things that I'm asking about.

THE COURT: I'm going to overrule the objection to the extent that Dr. Lodge can answer that question.

THE WITNESS: Or can remember them all.

THE COURT: If it's confusing, you'll have to unpack it.

THE WITNESS: One at a time, please.

MR. RIESER: Okay.

BY MR. RIESER:

Q. Let me ask it this way. Do you recall what information you turned over in response to the FOIA request?

A. There have been two or possibly three information requests to the Army Corps. In every instance the Army Corps has asked us if we have any objection to releasing the requested information. In all instances we have said no, we do not have any objection,

please release the information. In fact, we have said please release, make sure you release this information too.
Q. There was a discussion earlier about proprietary control in the primers, do you remember that discussion?
A. Yes.
Q. Do you and your lab have a proprietary interest in data that doesn't include the description of the primers?
A. We have a proprietary interest routinely guarded by academics in order to be able to be the first to publish the data that you collect. We have not withhold information relevant to making management decisions and have worked extensively in many formats repeatedly to requests from the management agencies, including the Army Corps, to provide them the information that they think they need to make management decisions.
Q. Are you aware of whether the Army Corps or any of the other agencies to which this data has been released has in fact released it to the public?
A. In at least the most recent FOIA request, I got a CD from the Army Corps with all the data that, with all the reports that were released, and Dr. Chris Jerde on our team verified that those indeed were all the documents that we had asked be released.
Q. You were asked a question about the rotenone application at the O'Brien Lock and Dam in May, May, I believe, of 2010, and I believe your answer indicated that -- indicated the difficulty of recovery of dead fish as a potential basis for why no Asian Carp

were recovered as a result of that activity?
A. It's a possibility.
Q. Are you aware that the one of the agencies, and I don't know who, took underwater pictures of the bottom of the Calumet River at that location to identify the possibility of Asian Carp on the bottom?
A. I heard that some photographs were taken.
Q. In your report that has been proffered as Plaintiff's potential Exhibit 1 -- by the way, this was presented to the Army Corps in May of 2010 or did you say that's a different date?
A. I believe we first provided it to the Army Corps in April as -- I'm probably going to forget the right terminology, some interim final report or some kind of qualified final report, for comment and feedback from our colleagues at the Army Corps in order for us to prepare what would be the final report, which we then revised in response to their request very, very moderate revisions and provided them with this copy in July.
Q. In July of 2010?
A. Yes, as I said earlier, on page 3 the date is wrong.
Q. Are you aware of why this report wasn't released until you provided it today, I should say until the States provided it today?
A. I can't say why it wouldn't have been released. I'm not sure.
Q. One of the discussions you have in this exhibit is the rate

of progress of Asian Carp up the Illinois River and towards the Sanitary & Ship Canal, and one of the statements that are in this report is that one of the difficulties for measuring the rate of progress had to do with the morphology of the stream, the shape of the stream. As it got closer to the Sanitary Ship Canal, it became more channelized, less bays and inlets, and that as a result of that, it was difficult to find Asian Carp using traditional methods, correct?

A. Yes, I think you're referring to the parts of the canal that are quite deep and rectangular. That's not very good habitat for the effectiveness of electrofishing.

Q. Is it equally possible that the Asian Carp are not there because that's not a habitat that's favorable to them.

A. Possible.

MR. RIESER: Excuse me, your Honor.

(Pause)

THE COURT: So just a moment ago I think we were all here except Lois, and that was good for her to take a break, but what we have ascertained here, as best I can tell, is that Mr. Rieser has five more minutes, Mr. Ames has nothing on cross, Mr. Reichel will do his best to do his redirect quickly, and we all turn into pumpkins at 5:20, fair enough?

MR. RIESER: Thank you, your Honor.

THE COURT: And then if that means Dr. Lodge has to come back, that's what it will mean, but let's hope it doesn't mean

that, looking at the pained look on his face.

Go ahead, Mr. Rieser.

BY MR. RIESER:

Q. You were asked questions earlier by Mr. Reichel about the Chicago Area Waterway System as a conduit for invasive species to move both directions, from the lake to the river and from the river to the lake.

Would you agree that the St. Lawrence Seaway is also a conduit for invasive species?

A. Yes, but a much less important one since it connects an ocean, salt water ocean with a fresh water ocean.

Q. So there have not -- would you agree that there have been a significant number of invasive species that have been delivered to the Great Lakes via the St. Lawrence Seaway?

A. Oh, absolutely. Roughly 65, 70 percent of the species non-native, not necessarily invasive species in Great Lakes have been delivered by ships.

Q. You were asked a number of questions by Mr. Reichel about potential management strategies regarding the Chicago Waterway System.

Do you know whether there is any discussions or have you been involved in any discussions regarding applying those same management activities to the St. Lawrence Seaway?

A. Yes, we have done a number of studies and continue to be involved in research relevant to shipping as a pathway of the

delivery of non-native species also.
Q. Have there been discussions about closing the St. Lawrence Seaway in response to the invasive species that are coming through it?
A. Yes, there have been discussions among many parties about that.
Q. In addition, you're aware that there have been a number of Asian Carp identified in Lake Erie?
A. Yes, what I know is derivative from the compilation of research in the Kolar, et al. book that I referred to earlier with additional information coming conversations with Dwayne Chapman and others. It's my understanding that there have been five individual bighead carp caught in Lake Erie.
Q. Do you know whether -- have you been -- strike that.
Have you been in discussions with anybody about performing an eDNA analysis in Lake Erie?
A. Yes, as I described earlier, we are just launching a newly funded Great Lakes Restoration Initiative Project to help the agencies develop a surveillance program targeting the tributaries of all the Great Lakes that would appear to be at the highest risk or rather those that would be most favorable to reproduction by silver or bighead carp.
Q. In the literature about eDNA which you have cited to, has a methodology been identified for calculating a margin of error?
A. A margin of error of what?

Q. With respect to positive versus negative findings?
A. Again, we would have to have a more specific question. I don't know what to add other than the detection limit discussion we had earlier.
Q. Is it your answer then that you don't know whether there is a margin of error methodology discussion in the literature about eDNA?
A. Nothing is coming immediately to mind, but margin of error is a general concept that can be applied to many specific things, so I just am not sure to what you refer.
Q. Have you developed a margin of error with respect to your own findings with respect to the eDNA?
A. We have by the EPA audit's estimation taken extraordinary measures for a research laboratory for quality assessment/quality control, and as we have already discussed, since the EPA audit we have instituted yet more quality assurance and quality control. We have communicated in complete detail those practices to the Army Corps of Engineers and to others who have expressed interest in it.
Q. Have you made any statistical calculations with respect to a margin of error as to the accuracy of the sampling?
MR. REICHEL: Objection, your Honor. This has been asked I think multiple times.
THE COURT: I'm going to sustain the objection. Someone did ask him that, I can't remember which one, but

someone. There was a discussion of statistics.

MR. RIESER: Okay.

BY MR. RIESER:

Q. You were asked a question, I believe by Mr. Krauskopf, about the number of samples that were taken above the -- no, I'm sorry, it was by Mr. Hill about the number of samples that were taken above the barrier in 2010, and I think your answer was it was somewhere between 500 and 600 samples.

A. That is what I said. I also qualified that that I wasn't sure I was recalling that correctly.

Q. So if Colonel Quarles in his affidavit submitted as part of the United States briefs that it was 530, that sounds like a good number?

A. I would go along with Colonel Quarles. If he is saying that on the basis of the reports that we have delivered to him, then that's fine.

Q. I believe you also said that --

A. Sorry, that probably does not include the 450, which are the result of a separate modification in response to a request from the Corps to do additional samples. Those are the samples to which I have referred multiple times that are still under analysis.

Q. So the 450 samples that you referred to in your testimony is not a subset of the 500, all of the 500 --

A. I do not think so.

Q. All the 530 have been analyzed?
A. Again, I have not read Colonel Quarles' declaration, so I don't know exactly what it says. My guess would be that he would be referring to those samples that have been completely analyzed and therefore reported to him.
Q. And of those samples is it correct that only 10 showed positive for Asian Carp species?
A. I do not remember, but again --
Q. And the 450 are samples in addition to this that's part of the -- part of the transition from your laboratory to the Army Corps' laboratory of this activity?
A. Well, in a sense it's instead of the transition. It is an interim measure to which we reluctantly agreed in order to sort of fill in the gap until the Army Corps lab is able to take over the surveillance program.
Q. Do you know when the data from that sampling is going to be made available?
A. It should be soon. We made it clear when we agreed to do that that it had to take a lower priority to other commitments that we had made in the laboratory.
MR. RIESER: Thank you very much. I have no further questions.
THE COURT: Mr. Rieser, thank you. Okay.
And Mr. Ames has nothing for now, thank you, sir.
And so Mr. Reichel.

MR. REICHEL: Thank you, your Honor.

REDIRECT EXAMINATION

BY MR. REICHEL:

Q. Dr. Lodge, I would just like to follow up on one line of questioning.

A. Only one?

Q. No. On one -- I'm sorry. I should be careful when a lawyer says one more question. I was going to qualify that.

A. I think I have heard that a few times today.

Q. Okay. If you look at what was marked as Plaintiff's proposed Exhibit 1, the risk assessment report, is that still in front of you?

A. Yes.

Q. Will you please turn to Page 28. Ms. Rudolph asked you a question about some language that appears at Page 28 in the second full paragraph on that page, sir?

A. Yes.

Q. The sentence that said in part, said that "The electric barriers constructed and manned by the USACE," et cetera, skipping text, "should be as effective at preventing other invasive fish species in the Mississippi from invading the Great Lakes." Do you see that?

A. Yes.

Q. Okay. After that sentence that she asked you about, did you and your co-authors make any other observations about the effect

of the barrier vis-à-vis other fish movement in other directions or other species?

A. Yes. The point of acknowledging that was to contrast the effectiveness, the unknown effectiveness of the barrier against fishes with its effectiveness against other kinds of organisms. So in the rest of that same paragraph, what we go on to say is that there are many other organisms, plants, for example, for which the barrier would have no effectiveness whatsoever.

In addition, we note in that same paragraph that Barrier IIA, the second barrier to be made operational, was designed to be more effective toward upstream migration of fishes rather than downstream migration of fishes. And of course, we are putting that in the context of the threat of dispersal that occurs for fishes and other organisms in both directions.

Q. Dr. Lodge, I'm going to -- may I approach, your Honor?

THE COURT: Oh, sure.

MR. REICHEL: Just for the record, I'm handing the witness what was Exhibit 14 to our motion for preliminary injunction, which, Dr. Lodge, I represent to you is a copy of your January 2010 declaration. You were asked a series of questions about that I just wanted to follow up on.

BY MR. REICHEL:

Q. Could you turn, sir, to Paragraph 49, which I believe Mr. Krauskopf asked you about. I believe it's the last paragraph or one of the last.

A. Yes.
Q. Okay. I can't recall verbatim what he asked you. I believe you were asked -- well, first of all, on Paragraph 49, paraphrasing since I don't have it in front of me at the moment, you observed in substance that you believed there were at least a few bighead or silver carp above the barrier, is that correct?
A. Yes, our eDNA results indicate that at least a few individuals of silver and bighead carp have ready access to Lake Michigan via the O'Brien Lock and Dam.
Q. I recall on cross-examination you offered to explain why you reached that conclusion, you were not given an opportunity to do so. So I'm going to give you the opportunity now to explain from a scientific perspective why it is that first, that you believed at the time you wrote that, and to the extent you believe it today, why you conclude that the data indicated that at least a few of those fish existed above the barrier?
A. Well, I think the pattern, the spatial pattern of occurrence of positive eDNA results is most likely the result of multiple fishes when you consider the great distances that separate positive results for both silver and bigheads. So that would be one modest line of evidence on which I would draw that conclusion.

Given the information that's become available since I wrote this, I would regard the evidence that has come from the intensive efforts at shocking and electrofishing, contrasted with

the great number of fish recovered from rotenoning as a stronger line of evidence for the occurrence of many fish when you consider the proportion of fish that are likely captured in traditional tools, the proportion of fish that are likely recovered in rotenoning, and the fact that there have been in three instances at least either silver or bigheads seen or caught, that would indicate just on a statistical basis alone that there are probably one or more orders of magnitude more fish there than have been caught.

Q. And I think you were asked this question by a number of counsel for defendants, but this is also a subject that you addressed in your declaration, and that is the method that you and your colleagues have employed for eDNA analysis does not -- you have explained repeatedly that a positive result you infer as indicating the recent presence of at least one live fish in the vicinity, et cetera, correct?

A. Yes.

Q. But you're uncertain scientifically, given the limitations on the method, as to, you're not able to quantify the number of fish that would be associated with or potentially associated with any one individual positive result, is that correct?

A. Yes, the most conservative interpretation is the one that I provided, which is at least one.

Q. But from a scientific standpoint, is it also possible that a single positive result may be associated with more than one fish?

A. It could certainly be associated with more than one fish.
Q. Mr. Krauskopf asked you a question, I'm just looking at my notes, something about the Asian Carp Control Plan from 2007. I may not be stating this correctly, but I believe in the context of his question he was referring to a document that was developed by the U.S. Fish & Wildlife Service. Are you familiar with that?
A. Vaguely familiar with it, as I said earlier.
Q. Well, in any event, I believe he asked you about whether or not -- he said something about that 2007 document referring to alternative explanations for eDNA.

Again, assuming, if you don't have it in front of you, I want you to assume that that document or plan was developed in 2007. Do you find it plausible that the document would have referred to the use of eDNA for the detection of bighead and silver carp?
A. No, it could not possibly have nor could it have taken into account the many discussions and considerations that have occurred since then about trying to evaluate the plausibility of those alternative pathways.
Q. Okay. A couple of counsel have asked you questions about the number of negative -- total number of samples taken in a given time period, and in substance how many of those were positive versus negative or asking you in effect to compare the number of positive to negative samples.

Again, you may have touched on this earlier, but I want

the record to be clear as to how you as a scientist using this method and your understanding of what can be inferred from a positive versus a negative sample.

Does the fact that a number of negative samples in a given time period, the fact that you have got a number of negative samples, does that establish that only, only that bighead or silver carp were only present in the waterway where positive samples existed?

A. No.

Q. And why is that?

A. A positive result conveys much more information than a negative result.

Q. I believe Mr. Hill asked you some questions about the EPA audit report. And again, bear with me as I try to decipher my notes here, but I think one of the questions he asked you was along the lines that the, that the EPA audit team found that your work was not reproducible. Do you recall being asked that?

A. Yes.

Q. And I can give you a copy of the report if you would like to refer to it. Do you have any understanding of what -- to the best of your recollection --

A. Yes.

Q. -- what did the report say about reproducibility?

A. The context of that was primarily that we had not written down all the procedures that we used, particularly the quality

control/quality assurance procedures. So the report was laudatory about our practices, but recommended that we formalize those in writing so that we could hand others a document that would more completely allow someone else to reproduce the results. It did not reflect any concern about the lack of reproducibility of the results if another lab followed our procedures, it simply reflected a concern that we had not formally written our procedures sufficiently so that another lab could be confident that they would follow the same procedures.

Q. Mr. Krauskopf also asked you some questions about an article that you and Cynthia Kolar co-authored, I believe in 2002, Ecological Predictions and Risk Assessment For Alien Fishes in North America. Do you recall being asked about that?

A. Yes.

Q. And I believe he asked you about the appearance or the categorization in that study of the species silver carp. Do you recall being asked about that?

A. Yes.

Q. Do you recall from memory whether or not elsewhere in the text of that report you offered any further explanation or commentary upon presence or absence of potential adverse impact of that species?

A. Yes, we commented specifically on our results, qualified those conclusions with respect to silver carp on the basis that silver carp has such unusual characteristics, specifically with

this jumping behavior that has been so important to the human reaction to it, that our statistical analysis based on traits common to species that have been invasive and on the other hand those that had not been invasive simply was not able to accommodate such an unusual fish, so we were less confident in those results than for other fishes.

Q. Do you recall whether or not in that same article, Dr. Lodge, you addressed the question of or you attempted to distinguish between the potential adverse impacts of that species in the Great Lakes versus some other waters connected to the Great Lakes?

A. Yes, I think we also were cautious because already at that time it was clear to knowledgeable observers that silver carp had had quite substantial negative impacts in the Mississippi River and the Illinois River and that gave us pause in concluding in the face of that evidence to be too confident about a lack of effect in the Great Lakes, acknowledging that they're different environments.

Q. Sure. And again, this is a report you authored some years ago. Do you recall whether or not in that report you drew any distinction between, for lack of a better term, the open waters of the Great Lakes and rivering systems? If you don't recall --

A. I don't recall that. I can imagine what we might have said had we said something about it.

MR. REICHEL: Your Honor, may I approach?

THE COURT: Sure.

BY MR. REICHEL:

Q. Dr. Lodge, I'm landing you a copy of that article that we referred to.

A. Yes.

Q. And I would like to direct your attention to -- this appears at Page 1235 of this published version and the center uppermost column -- just take a moment to read that and tell me if that refreshes your recollection.

A. Yes. So the statement says: "In addition, all our predictions are applicable to the Great Lakes proper, not to tributaries and large river systems in which these carp species, for example, are already established and causing strongly negative consequences."

So that again was in reference in the context of this article to both silver carp and black carp, which we also considered in this article. We had not considered bighead carp.

So that was acknowledging the fact that our, the focus of this entire article was on the Great Lakes proper, not on the tributaries, and in this context it's important to recognize that, that impacts in the tributaries could be very important in addition to impacts in the lakes.

MR. REICHEL: May I have just a moment, your Honor?

THE COURT: Sure.

(Pause)

MR. REICHEL: With that, your Honor, I'm finished with my redirect.

THE COURT: Okay, very well, thank you, sir.

MR. RIESER: Thank you, Dr. Lodge.

THE COURT: Anybody have anything on the six points that Mr. Reichel just covered with Dr. Lodge. Anyone?

(No response)

THE COURT: Okay. Hearing no takers, I'll excuse Dr. Lodge. Thank you very much, sir, for your entire day.

THE WITNESS: Thank you, your Honor.

(Witness excused)

THE COURT: Let's talk about tomorrow then just for a couple minutes in terms of -- you have no further witnesses at this time?

MR. REICHEL: That's correct, your Honor.

THE COURT: Okay, very well. So we will, maybe what I can do is ask you all to confer amongst the defense side and see what order you want to put the witnesses in tomorrow, unless you have already done that. Have you already done that? Are there people who have to go tomorrow? Obviously, we have got the witness coming on at 10:30 who has to go tomorrow.

Are there other people who are available only tomorrow? Mr. Krauskopf.

MR. KRAUSKOPF: Dr. Cook, Sandra Cook is here.

THE COURT: How long do you anticipate?

MR. KRAUSKOPF: Short.

MS. RUDOLPH: Your Honor, General Peabody is also only available tomorrow as well. We will confer amongst defendants.

THE COURT: Okay, and as I said before, this was about what I think we anticipated for Dr. Lodge. I was told about two and a half hours of direct and that's about what we had, and the cross and redirect and recross, there was no -- was about two and a half hours.

We can start a little earlier tomorrow, and I'm going to suggest tomorrow why don't everybody be ready to go at 9:30. I have a status at 9:30 that I'm hoping will be very short and I will make sure we start -- sometimes I don't come out until five or ten after 9 because usually when we call the 9:00s right at 9:00, we don't have both sides present in most of the cases, but we will work on that tomorrow and hope that we do well.

So if we start at 9:30 tomorrow, I'm hoping we will get through by 5:00 everybody, that's my hope. As I said before, obviously, if anybody trickles into Friday, so be it. It just may cut into the amount of time you guys have to argue. That may be merciful for all of us.

Anyhow, I appreciate everybody being here today and maybe if you guys could coordinate on your order of witnesses and just let me know first thing in the morning how we are going to do it just so I can know come what's coming down the pike, okay? If we start at 9:30 tomorrow, that will maximize our likelihood

of getting everybody in tomorrow, okay?

Anything else you all wanted to take up tonight before we break?

(No response)

THE COURT: Thanks to everybody. Then we will see you tomorrow at 9:30. Take care.

(Adjournment to September 8, 2010, at 9:30 a.m.)

* * *

I certify that the above is a true and correct transcript of proceedings had in the above matter.

/s/ Lois A. LaCorte

_____ _____

Lois A. LaCorte Date